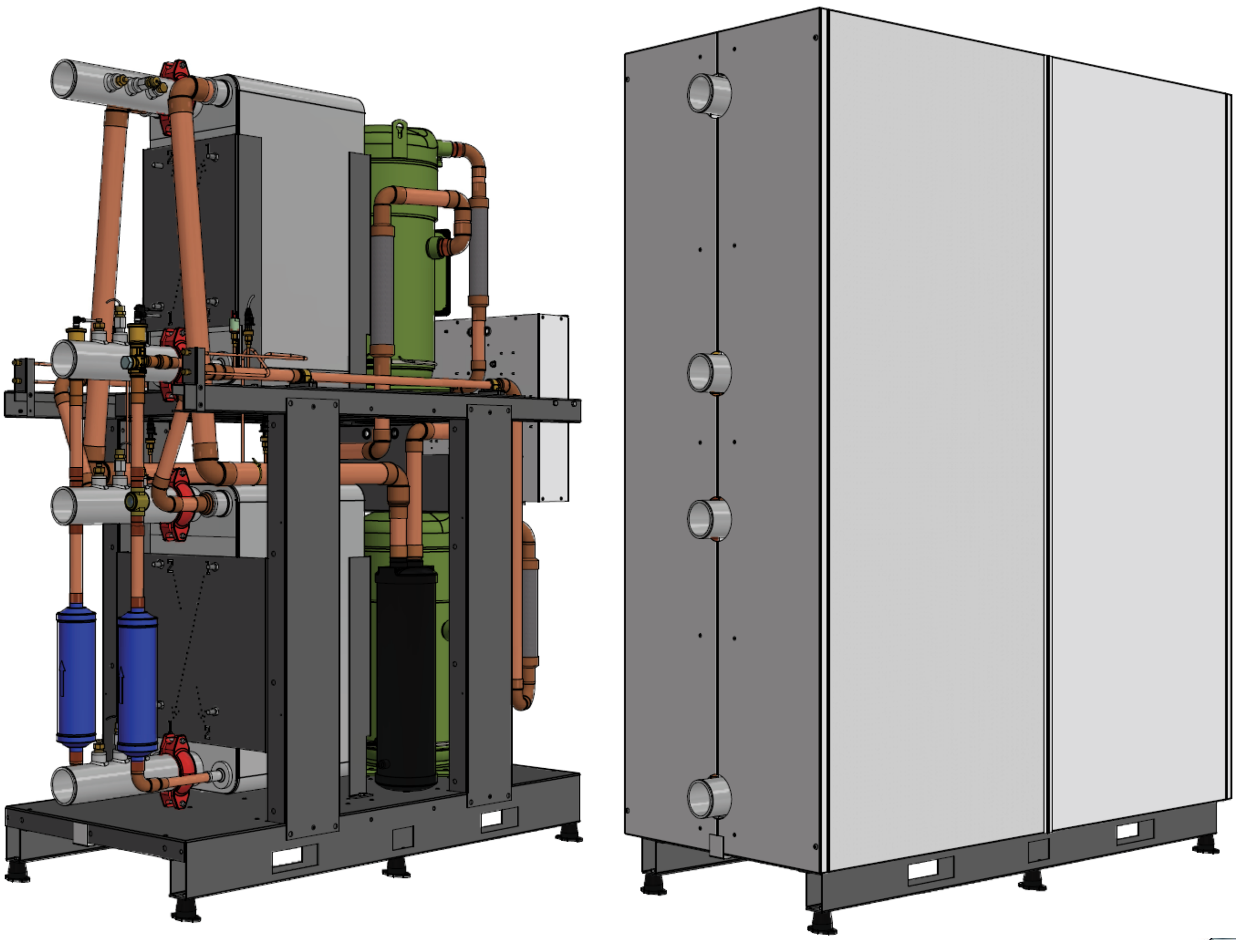
Application, Installation, & Service Manual

Commercial W-Series & WH-Series
Water to Water Heat Pumps

Dual Refrigeration Circuit
Model Sizes 150-1000 (12 to 81 ton)



Maritime Geothermal Ltd.
P.O. Box 2555, 170 Plantation Road
Petitcodiac, NB E4Z 6H4
(506) 756-8135

info@nordicghp.com
www.nordicghp.com
002097MAN-04

ISSUE 03: 18-Oct-2023

SAFETY PRECAUTIONS

WARNING: **Ensure all access panels are in place and properly secured before applying power to the unit. Failure to do so may cause electrical shock.**

WARNING: **Before performing service or maintenance on the heat pump system, ensure all power sources are DISCONNECTED. Electrical shock can cause serious personal injury or death.**

WARNING: **Heat pump systems contain refrigerant under high pressure and as such can be hazardous to work on. Only qualified service personnel should install, repair, or service the heat pump.**

CAUTION: **Safety glasses and work gloves should be worn at all times whenever a heat pump is serviced. A fire extinguisher and proper ventilation should be present whenever brazing is performed.**

CAUTION: **Venting refrigerant to atmosphere is illegal. A proper refrigerant recovery system must be employed whenever repairs require removal of refrigerant from the heat pump.**

Model Nomenclature

W - 400 - H - P - 2D - PP - xx

Series:
W = liquid to water
WH = high temperature liquid to water
(sizes 150-800 only)

Nominal Size:
150 = 12 ton
185 = 15 ton
240 = 20 ton
300 = 23 ton
400 = 30 ton
500 = 40 ton
600 = 50 ton
800 = 65 ton
900 = 70 ton
1000 = 81 ton

Functions:
H = Heating
AC = reversing valve *(sizes 150-800 only)*
W = desuperheater for DHW *(sizes 150-400 only)*

Refrigerant:
P = R410a (W series)
B = R134a (WH series)

Revision:
01, 02 etc.

Indoor Loop Exchanger:
P = brazed plate

Outdoor Loop Exchanger:
P = brazed plate

Compressor:
D = dual scroll

Voltage Code:
1 = 208/230-1-60
2 = 208-3-60
4 = 460-3-60
5 = 575-3-60
6 = 220-1-50
7 = 380-3-50
8 = 400-3-60

go to TABLE OF CONTENTS

APPLICATION TABLE - W-SERIES

MODEL	FUNCTION	REFRIGERANT	VOLTAGE	COMPR.	OUTDOOR COIL	INDOOR COIL	REVISIONS			
W-150	H HAC	P	1 2 4 5 6 7	D	P	P	05			
W-185	H	P	2 4 5 7	D	P	P	03			
	HAC	P		D	P	P	04			
W-240	H	P	2 4 5 7	D	P	P	02			
	HAC	P		D	P	P	03			
W-300	H	P	2 4 5 7	D	P	P	02			
	HAC	P		D	P	P	03			
W-400	H	P	2 4 5 7	D	P	P	02			
	HAC	P		D	P	P	03			
W-500	H	P	4 5 7	D	P	P	02			
	HAC	P		D	P	P	03			
W-600	H	P	4 5 7	D	P	P	02			
	HAC	P		D	P	P	03			
W-800	H	P	4 5 7	D	P	P	02			
	HAC	P		D	P	P	03			
W-900	**H**	P	4 5 7	D	P	P	02			
W-1000	**H**	P	4 5 7	D	P	P	02			

Maritime Geothermal Ltd. has a continuous improvement policy and reserves the right to modify specification data at any time without prior notice .

go to TABLE OF CONTENTS

APPLICATION TABLE - WH-SERIES

MODEL	FUNCTION	REFRIGERANT	VOLTAGE	COMPR.	OUTDOOR COIL	INDOOR COIL	REVISIONS			
WH-150	H HAC	B	1 2 4 5 6 7	D	P	P	05			
WH-185	H	B	2 4 5 7	D	P	P	02			
	HAC	B		D	P	P	03			
WH-240	H	B	2 4 5 7	D	P	P	02			
	HAC	B		D	P	P	03			
WH-300	H	B	2 4 5 7	D	P	P	02			
	HAC	B		D	P	P	03			
WH-400	H	B	2 4 5 7	D	P	P	02			
	HAC	B		D	P	P	03			
WH-500	H	B	4 5 7	D	P	P	02			
	HAC	B		D	P	P	03			
WH-600	H	B	4 5 7	D	P	P	02			
	HAC	B		D	P	P	03			
WH-800	H	B	4 5 7	D	P	P	02			
	HAC	B		D	P	P	03			

APPLICATION TABLE - FIRMWARE AND PC APP

Firmware	Version	Associated PC APP	Version
MGT GEN2 Bootload Firmware	V3.60+	MGT GEN2 PC APP	V2.00+

Maritime Geothermal Ltd. has a continuous improvement policy and reserves the right to modify specification data at any time without prior notice .

go to TABLE OF CONTENTS

Table of Contents

Tables & Documents 6

System Description 7
General Overview 7
1. Heating Mode 7
2. Cooling Mode 7

Installation Basics 8
Unpacking the unit 8
Unit Placement 8
General Bill of Materials 8

Wiring 9
Power Supply Connections 9
Indoor Loop Circulator Pump Wiring 9
Outdoor Loop Circulator Pump Wiring 9
Outdoor Loop Water Valve Wiring 9
Indoor Loop Water Valve Wiring 10
Control Transformer 10
BACnet Control Connections 10
Setpoint Control Connections 10
Setpoint Control: Aux. Connections 10
Signals/Hardwired Control Connections 11
Disable Switch (field installed) 11
Other Connections 11
002188CDG - Typ. GEN2 Indoor Circ. Connections 12
002067CDG - Typ. Heating Only Zone Wiring (Setpoint) 13
002069CDG - Typ. Heating Only Zone Wiring (Signals) 14

Piping & Loop Information 15
Water Loop Connections 15
Headers for Multiple Units 15
Ground Loop Systems 16
Open Loop Systems (Water Quality Guidelines) 16
Modulating Water Valve 16
002366PDG - Recommended Buffer Tank Piping 17
002367PDG - Auxiliary Boiler Piping 18
002528PDG - Buffer Tank Piping - Multiple Units 19
002240PDG - DHW with Single Wall Condenser 20
002252PDG - Two Tank Piping with a Rev. Heat Pump 21
002527PDG - 2 Tank Piping w/Multiple Rev. Heat Pumps 22
002288PDG - Two Tank Simultaneous Heating/Cooling 23
001680PDG - Two Tank Sim. Heating/Cooling (Diverting) 24
002286PDG - Geothermal Snow Melt w/Reheating 25
000530PDG - Typical Zone Types 26

Operation 27
1. BACnet Control 27
2. Signals / Hardwired Control 27
3. Setpoint Control 27
Setpoint Control Method 1 - Indoor Loop (ICR), One Tank 27
Typical Temperature Setpoints 28
Summer Setback 28
Outdoor Reset 29
Setpoint Control Method 2 - Indoor Loop (ICR), 2 Tanks 30
Setpoint Control Method 3 - External HTS/CTS, One Tank 31
a) Heat Pump Mode 31
b) Chiller Mode 32
Setpoint Control Method 4 - External HTS/CTS, 2 Tanks 33

PC Application (PC APP) 34
PC Application Menus 34

LCD Interface & Menus 47

BACnet Interface 49

Startup Procedure 53
Pre-start Inspection 53
Unit Startup 54
Startup Record 55

Routine Maintenance 56

Troubleshooting Guide 57

Repair Procedures 66
Pumpdown Procedure 66
General Repair Procedure 66
Vacuuming & Charging Procedure 66
Compressor Replacement Procedure 67
Control Board Replacement Procedure 68
LCD Interface (Display) Board Replacement Procedure 69

Model Specific Information 70
Flow Rates & Volumes 70
Refrigerant Charge 70
Shipping Information 70
Operating Temperature Limits 71
Loop Pressure Drop Data 72

Standard Capacity Ratings - W-Series 74
Performance Tables (Heating/Cooling): W-150 76
Performance Tables (Heating/Cooling): W-185 77
Performance Tables (Heating/Cooling): W-240 78
Performance Tables (Heating/Cooling): W-300 79
Performance Tables (Heating/Cooling): W-400 80
Performance Tables (Heating/Cooling): W-500 81
Performance Tables (Heating/Cooling): W-600 82
Performance Tables (Heating/Cooling): W-800 83
Performance Tables (Heating/Cooling): W-900 84
Performance Tables (Heating/Cooling): W-1000 85

Performance Tables (Ice Making/Arena Application) 86

Performance Tables: WH-150 91
Performance Tables: WH-185 92
Performance Tables: WH-240 93
Performance Tables: WH-300 94
Performance Tables: WH-400 95
Performance Tables: WH-500 96
Performance Tables: WH-600 97
Performance Tables: WH-800 98

Electrical Specifications - W Series 99
Electrical Specifications - WH Series 100
Electrical Diagrams (All Voltages) 101
Refrigeration Circuit Diagrams 106

Dimensions - Without Enclosure (Sizes 150-400) 109
Dimensions - With Enclosure (Sizes 150-400) 110
Dimensions - Without Enclosure (Sizes 500-1000) 111
Dimensions - With Enclosure (Sizes 500-1000) 112

Appendix A: Control Board Description 113

Appendix B: USB Driver Installation 117

Appendix C: PC App Installation (Win11) 118

Appendix D: PC App Installation (Win10) 119

Appendix E: Updating Firmware 120

Warranty 123

go to TABLE OF CONTENTS

Tables & Documents

Tables

Table 1 - Power Supply Connections ... 9
Table 2 - Indoor & Outdoor Circulator Connections ... 9
Table 3 - Water Valve Connections ... 10
Table 4 - BACnet Connections ... 10
Table 5 - Setpoint Control Connections ... 10
Table 6 - Setpoint Control: Aux. Connections ... 11
Table 7 - Signals Control Connections ... 11
Table 8a - Typical W-Series Aquastat Settings ... 11
Table 8b - Typical WH-Series Aquastat Settings ... 11
Table 9 - Loop Connection Sizes ... 15
Table 10 - Horizontal Headers Size for Multiple Units ... 15
Table 11 - Buffer Tank Size ... 15
Table 12 - Water Quality Limits ... 16
Table 13a - Typical W-Series Setpoints ... 28
Table 13b - Typical WH-Series Setpoints ... 28
Table 14 - Typical Setpoints: HTS/CTS Method, Chiller Mode ... 32

Table 15 - BACnet Objects - Control Signals (Read/Write) ... 49
Table 16 - BACnet Objects - Operation Mode Description (Read Only) ... 49
Table 17 - BACnet Objects - Limits Description (Read Only) ... 49
Table 18 - BACnet Objects - Data (Read Only) ... 50
Table 19 - BACnet Objects - Alarm Descriptions (Read Only) ... 51
Table 20 - BACnet Objects - Fault Descriptions (Read Only) ... 52

Table 21 - Flow Rates & Volumes ... 70
Table 22 - Refrigerant Charge (Per Circuit) ... 70
Table 23 - Shipping Information ... 70
Table 24a - W-Series Operating Temperature Limits ... 71
Table 24b - WH-Series Operating Temperature Limits ... 71
Table 25 - Loop Pressure Drop Data ... 72
Table 26 - W-Series Standard Capacity Ratings ... 74
Table 27 - W-Series Electrical Specifications ... 99
Table 28 - WH-Series Electrical Specifications ... 100

Table A1 - Control Board Connector Descriptions (Top) ... 114
Table A2 - Control Board Connector Descriptions (Left Side) ... 114
Table A3 - Control Board Connector Descriptions (Bottom) ... 115
Table A4 - Control Board Connector Descriptions (Right Side) ... 116

Documents

002188CDG – Commercial W Typical ICR Connections for GEN2 Setpoint Control ... 12
002067CDG - Typical Zone and Auxiliary Wiring with GEN2 Setpoint Control (Heating Only) ... 13
002069CDG - Typical Zone and Auxiliary Wiring with GEN2 Hardwired Option (Heating Only) ... 14
002366PDG - Recommended Hydronic Buffer Tank Piping ... 17
002367PDG - Auxiliary Boiler Piping ... 18
002528PDG - Buffer Tank Piping - Multiple Units ... 19
002240PDG - High Temperature Single Wall Unit Connection to DHW Tank ... 20
002252PDG - Two Tank System Piping with a Reversing Heat Pump ... 21
002527PDG - Two Tank Piping with Multiple Reversing Heat Pumps ... 22
002288PDG - Two Tank Simultaneous Heating / Cooling ... 23
001680PDG - Two Tank Simultaneous Heating / Cooling (Diverting Arrangement) ... 24
002286PDG - Geothermal Snow Melt System with Warm-Weather Ground Loop Reheating ... 25
000530PDG - Typical Zone Types for Hydronic Applications ... 26

001717SCH - W-150 to 1000-H***-*-*D-PP High Voltage Schematic Diagram ... 101
002414SCH - W-150 to 1000-H***-*-*D-PP w/Disconnect High Voltage Schematic Diagram ... 102
001718SCH - W-150 to 1000-H***-*-*D-PP Schematic Diagram ... 103
001719ELB - W-150 to 1000-H***-*-*D-PP Electrical Box Diagram ... 104
002415ELB - W-150 to 1000-H***-*-*D-PP w/Disconnect Electrical Box Diagram ... 105
001720RCD - W-150 to W-1000-H(W) Refrigeration Circuit Diagram - Heating Mode ... 106
001721RCD - W-Series HAC(W) (150-800) Dual Circuit Refrigeration Circuit Diagram—Heating Mode ... 107
001722RCD - W-Series HAC(W) (150-800) Dual Circuit Refrigeration Circuit Diagram—Cooling Mode ... 108

go to TABLE OF CONTENTS

System Description

General Overview

These units are 2-compressor dual refrigeration circuit water-to-water heat pumps. They have a 'vertical chiller' style design with external loop headers, for ease of passage through doors and convenience for multiple-unit installations. They are available in any world electrical service.

The **W-series** uses R410a refrigerant to achieve a standard geothermal temperature range: the outdoor loop can operate at as low a temperature as **0°F (-17°C)** for ice production, and the indoor loop can reach **130°F (54°C)** leaving water temperature under standard ground loop conditions.

The **WH-series** uses R134a refrigerant to achieve an upward shift in temperature range: the outdoor loop requires a minimum incoming water temperature of **45°F (7°C)**, so is suitable for use on many open loop or heat recovery applications, or closed ground loops in warm climates. The indoor loop can reach **160°F (71°C)** leaving water temperature.

The units are built on industrial-strength steel frames, with removable enclosure insulated with 1" insulation. The indoor and outdoor loop hydronic heat exchangers are both true dual circuit stainless steel brazed plates with copper brazing. Two single-stage scroll compressors are standard, as are two Electronic Expansion Valves (EEV's). The electronic control board has full local unit hydronic temperature control, laptop connectivity via USB with free PC App, LCD interface, electronic readout of all pressures and temperatures, data logging & graphing, and BACnet.

1. Heating Mode

In heating mode, the heat pump heats water in an indoor loop or buffer tank, while extracting heat from an outdoor loop.

For commercial environments, heat pumps are normally sized and the system laid out by a mechanical consulting engineer. It is good practice to design the system with non-reversing heat pumps that always use 'heating mode': heating with the hot indoor loop, and cooling with the chilled outdoor loop. (See simultaneous heating-cooling diagrams in the Piping chapter.) Multiple units are easily installed side by side with zero clearance using horizontal headers, to provide redundancy as well as the ability to meet large loads. Control is normally done using the building control system via BACnet, and includes lead/lag stage rotation to evenly distribute the run hours between compressors. Loop circulation pumps are also centrally controlled via BACnet.

It is also possible to use the heat pump in standalone operation or in small numbers of units. In this case, hydronic temperature control functionality built into the heat pump may be used, and circulation pumps and/or water valves (either on/off or modulating) can be powered and controlled by the heat pump. A third control option is through dry contacts by an external thermostat or controller.

Hydronic heating systems are easily zoned, and zones may be in-floor heating, hydronic air handlers, or other hydronic devices suitable for the water temperature. When a zone requires heat, its zone thermostat calls for a zone circulator pump or zone valve to activate, so that hot water from the buffer tank is sent to the zone requiring heat. Note that there is no direct connection between the zone thermostat and the heat pump, the functions of each being separated by the buffer tank.

2. Cooling Mode *(HAC models only)*

Reversing valves to swap the hot and cold loops are available on model sizes up to 400 (see Application Table on page 3). When reversing valve is activated, the indoor loop or buffer tank is chilled, and heat is rejected to the outdoor loop.

Hydronic cooling is usually done through hydronic air handlers, which have condensate drains to remove water that is removed while dehumidifying the air. In less humid climates, in-floor or radiant cooling is sometimes performed; such systems can't remove humidity from the air. In this case, care must be taken to ensure the cooling surface does not fall below the dew point temperature in order to prevent condensation on floor surfaces.

Four W-1000 heat pumps with enclosures installed, and 8" external horizontal loop headers

go to TABLE OF CONTENTS

Installation Basics

Unpacking the Unit

When the heat pumps reach the site, they should be unpacked to determine if any damage has occurred during shipment. Any visible damage should be noted on the carrier's freight bill and a claim filed.

Unit Placement

Locate the unit as per the system design drawings. The access panels on the ends of the units should remain clear of obstruction for a distance of **3 ft (1 m)** to facilitate installation and servicing.

Note that for multiple unit installations, horizontal headers will connect the units on the piping end. **Extra space must be allotted for the headers, which can be of substantial size (up to 12" in diameter).** Space for external accessories must also be planned for, e.g. strainers and valves (manual, electronic, balancing, or modulating). Headers and accessories are not included with the heat pump, and must be ordered or sourced separately.

Since all serving can be done from the ends, **no access is required to the long side panels, which are fully removable from the ends.** This means that multiple units can be installed side by side with minimal clearance, although if large headers obstruct access to the piping-end panels, side clearance may be provided to ease access to the components located there.

The heat pumps are provided with rubber mounting feet (shipped inside electrical box), which must be installed on site. These will preserve the frame finish and dampen vibrations when used on solid concrete floors. Optional spring feet should be ordered when heat pump is installed on floors with flex, e.g. mezzanines.

General Bill of Materials

This is not an exhaustive list, but is an example of the materials that may be required for a commercial installation.

FROM MARITIME GEOTHERMAL
- W/WH SERIES HEAT PUMP(S)
- INSULATED ENCLOSURE(S) [STANDARD]

OPTIONAL FROM MARITIME GEOTHERMAL
- SPRING FEET FOR MEZZANINE INSTALLATION
- OUTDOOR TEMPERATURE SENSOR FOR OUTDOOR RESET WHEN USING ONBOARD SETPOINT CONTROL
- HOT/COLD TANK TEMPERATURE SENSORS
- 0-10V MODULATING WATER VALVE(S)

LOOPS (AS SPECIFIED BY SYSTEM DESIGNER)
- FABRICATED HORIZONTAL HEADERS
- GROOVED (VICTAULIC) FLEXIBLE COUPLINGS
- STRAINERS - 16 MESH / 1 MM
- ON/OFF WATER VALVES
- BUTTERFLY (HAND) VALVES
- BALANCING VALVES
- CIRC. PUMPS, SIZED FOR REQUIRED FLOW & dP
- PIPE & FITTINGS
- ANTIFREEZE: METHANOL OR PROP. GLYCOL
- BUFFER TANK, OPT. W/ELEMENTS __kW
- SECONDARY WATER TO WATER HEAT EXCHANGERS

ZONES
- ZONES CIRCULATOR(S)
- ZONE TRANSFORMER & CIRC CONTACTOR
- ZONE VALVES (IF NOT INDIVIDUAL PUMPS)
- IN-FLOOR PIPING
- OTHER AIR HANDLERS, DUCTING
- ZONE THERMOSTATS
- RELAYS OR ZONE CONTR. (REVERSING SYSTEMS)
- ZONE SUPPLY & RETURN HEADERS
- PIPE & FITTINGS TO ZONES
- EXPANSION TANK

ELECTRICAL
- HEAT PUMP SERVICE WIRE
- BUFFER TANK ELEMENT SERVICE WIRE
- HEAT PUMP BREAKER
- BUFFER TANK ELEMENT BREAKER
- CONTACTOR & ELEC. BOX (IF NOT WITH TANK)
- THERMOSTAT WIRE 18-4
- THERMOSTAT WIRE 18-2
- FORK TERMINALS FOR TSTAT WIRE (6)

go to TABLE OF CONTENTS

Wiring

Power Supply Connections

The heat pump electrical box and also the enclosure (if used) have several knockouts of various sizes for the electrical connections.

A schematic diagram (SCH) and electrical box layout diagram (ELB) can be found on the electrical box cover of the unit as well as in the **Model Specific Information** chapter of this manual.

The Electrical Specifications in the **Model Specific Information** chapter contain information about the size of wire for the connections, as well as the recommended breaker size. These should be checked by referencing MCA and FLA by a qualified professional to ensure conformance to local codes. Power supply connections to the unit are made directly to the power block inside the electrical box and are as per **TABLE 1.** Ground is to be connected to the **GND** lug inside the electrical box.

TABLE 1 - Power Supply Connections		
Line	**Description**	**Voltages**
L1	**Line 1**	**All**
L2	**Line 2**	**All**
L3	**Line 3**	**All 3-phase (208-3-60, 460-3-60, 575-3-60, 380-3-50)**
N	**Neutral**	**No Connection**

IMPORTANT NOTE FOR 3-PHASE UNITS: If on startup compressor is noisy and not pumping, reverse L1 and L2 supply wires.

IMPORTANT NOTE: A properly qualified electrician should be retained for all connections to the heat pump and associated controls. The connections to the heat pump MUST CONFORM TO LOCAL CODES.

Indoor Loop Circulator Pump Wiring

The indoor loop circulator provides flow between the heat pump and the buffer tank. In most multiple-unit commercial installations, the circulators (and the heat pump) will be controlled by the building automation system, since one circulator may serve several heat pumps. Connect circulator pumps as per site drawings.

If the heat pump is to control the indoor circulator, there are dry contacts provided to control the circulator pump so that it will be turned on whenever the compressor operates. Wire to **CP1** and **CP2** on the terminal strip at the lower right side of electrical box, as shown on the following diagram **002188CDG** and the wiring diagram (SCH) in the **Model Specific Information** chapter of this manual. Ensure that the total current draw does not exceed the value indicated on the diagram.

There is also provision for directly connecting an indoor circulator contactor with 24VAC coil, without an external 24VAC source. See "Indoor Water Valve Wiring - ON/OFF", below.

The indoor circulator only will be activated at times when the compressor is not running, when using ***Setpoint Control*** (refer to **Operation** chapter of the manual). The heat pump will start and stop indoor circulators to sample the water temperature.

Outdoor Loop Circulator Pump Wiring

The outdoor loop circulator provides flow between the heat pump and the outdoor loop. In most multiple-unit commercial installations, the circulators (and the heat pump) will be controlled by the building automation system, since one circulator may serve several heat pumps. Connect circulator pumps as per site drawings.

If the heat pump is to control the outdoor circulator, there are dry contacts provided to control the circulator pump so that it will be turned on whenever the compressor operates. Wire to **CP1** and **CP2** on the terminal strip at the lower right side of electrical box, as shown on the following diagram **002188CDG** and the wiring diagram (SCH) in the **Model Specific Information** chapter of this manual. Ensure that the total current draw does not exceed the value indicated on the diagram.

There is also provision for directly connecting an outdoor circulator contactor with 24VAC coil, without external 24VAC transformer. See "Outdoor Water Valve Wiring - ON/OFF", below.

IMPORTANT: If the outdoor circulator is connected via **CP1** and **CP2,** it may be unnecessarily activated at times when the compressor is not running, if using the ***Setpoint Control*** option (refer to **Setpoint Control** chapter of this manual). Under Setpoint Control, the heat pump will start and stop indoor circulators connected via CP1 and CP2 to sample the water temperature when the heat pump is not operating. Therefore, if using Setpoint Control, outdoor circulators should be connected as per "Outdoor Water Valve Wiring - ON/OFF", below.

TABLE 2 - Indoor & Outdoor Circulator Connections	
Terminal	**Description**
CP1	**Dry contacts for circulator control**
CP2	
Use a 2-conductor 18ga cable.	

Outdoor Loop Water Valve Wiring

<u>ON/OFF</u>: Connect a 24VAC outdoor loop water valve between **OV1** and **GND** (terminals **DO_0** and **LC** on control board), as shown on the wiring diagram (SCH) in the **Model Specific Information** chapter. Ensure that the total current draw of all water valves does not exceed the value indicated on the diagram.

The outdoor circulator contactor may be connected in the same way, to avoid need for an external 24VAC transformer or to avoid activation during sampling when using Setpoint Control.

<u>MODULATING</u>: Connect a 0-10VDC or PWM water valve between **OV2** and **GND** (terminals **PWM3** and **GND** on control board), as shown on the wiring diagram (SCH) in the **Model Specific Information** chapter. An outdoor modulating water valve will give the control board the means to restrict the outdoor loop water flow in cooling mode on reversing units, in case a low outdoor loop temperature causes a dip in the head pressure and therefore suction pressure. This will prevent nuisance low pressure control trips, for example when using cold open loop well water in cooling mode. It will be closed when unit is off, and may act to limit suction pressure due to high outdoor loop temperature in heating mode depending on firmware revision.

The head pressure below which the modulating water valve will start restricting water flow can be adjusted via the Configuration page in the PC App. Default is 350 psi.

go to TABLE OF CONTENTS

Indoor Loop Water Valve Wiring

__ON/OFF__: Connect a 24VAC indoor loop water valve between **IV1** and **GND** (terminals **DO_1** and **LC** on control board), as shown on the wiring diagram (SCH) in the **Model Specific Information** chapter. Ensure that the total current draw of all water valves does not exceed the value indicated on the diagram.

The indoor circulator contactor may be connected in the same way, to avoid the need for external 24VAC transformer.

__MODULATING__: Connect a 0-10VDC or PWM water valve between **IV2** and **GND** (terminals **PWM4** and **GND** on control board), as shown on the wiring diagram (SCH) in the **Model Specific Information** chapter of this manual. An indoor modulating water valve will give the control board the means to restrict the indoor loop water flow in heating mode, in case a low indoor loop temperature causes a dip in the head pressure and therefore suction pressure. This will prevent nuisance low pressure control trips, for example in case a large zone containing cool water opens, or in case of generally low indoor loop temperature. It will be closed when unit is off (and not sampling for Setpoint Control). On reversing HAC units in cooling mode, valve may act to limit suction pressure due to high indoor loop temperature depending on firmware revision.

The head pressure below which the modulating water valve will start restricting water flow can be adjusted via the Configu-

TABLE 3 - Water Valve Connections		
Control Board Label	**Signal Name**	**Description**
PWM4	**IV2**	0-10VDC control signal for indoor modulating water valve
PWM3	**OV2**	0-10VDC control signal for outdoor modulating water valve
GND	**-**	Common/ground for IV2, OV2
DO_1	**IV1**	24VAC output to actuate indoor water valve or circulation pump contactor coil
DO_0	**OV1**	24VAC output to actuate outdoor water valve or circulation pump contactor coil
LC	**-**	Common/ground for IV1, OV1
Use 18ga cable.		

Control Transformer

The low voltage controls for 208/230-1-60 and 208-3-60 models are powered by a class II transformer with resettable breaker on the secondary side for circuit protection. Should the breaker trip, locate and correct the problem and then reset the breaker by pressing in on it.

All other voltage models have a transformer with primary and secondary fuses for circuit protection.

IMPORTANT NOTE: For 208/230VAC-1-60 units, if connecting to 208VAC power supply move the red wire connected to the 240 terminal of the transformer to the 208 terminal of the transformer.

BACnet Control Connections

In most multiple-unit commercial installations, the heat pump will be controlled by the building automation system. If using *BACnet MS/TP* for external control of heating/cooling demand and/or monitoring of status, use a shielded twisted pair to the connector at the bottom left of control board. There is an optional termination jumper located above the connector.

See the **BACnet Interface** chapter for wiring tips and object names.

TABLE 4 - BACnet Connections	
Line	**Description**
A	**Communication +**
B	**Communication -**
GND	**Ground**
Use a *shielded twisted pair* cable.	

Setpoint Control Connections

If not using a building automation system for control, the heat pump's built in aquastat functionality (with optional outdoor reset) known as "Setpoint Control" may be used. Refer to the **Operation** chapter of this manual for more information. If this control method is used, it eliminates the need for an external aquastat, and the ICR option also eliminates temperature probe in the tank(s). It provides a three stage system along with delay timer for the hydronic auxiliary heat.

No external control signals are required for non-reversing H models. For reversing HAC models, a dry contact between **RA** and the **O** signal is required to switch to cooling mode. **Drawing 002067CDG** shows a typical wiring setup for zones, zone circulator and hydronic auxiliary.

Note that for reversing models in cooling mode, it is important to choose zone thermostats or other control devices that continuously return an "**O**" signal, even when there is no cooling demand. This is to avoid repeated heating and cooling of the buffer tank on demand cycling, causing temperature lags and high electricity consumption.

Setpoint Control does not currently incorporate any lead/lag or other coordination between multiple units; that is, each heat pump operates independently. A small number of units connected to the same buffer tank may operate under Setpoint Control by using different setpoint temperatures for each stage of each heat pump.

TABLE 5 - Setpoint Control Connections	
Signal	**Description**
C or CA	**24VAC common (ground)**
R or RA	**24VAC hot**
O	**Reversing valve (HAC models only)**
Use a 3-conductor 18ga cable.	

An external temperature probe may be used with the on-board Setpoint Control routine, or two probes (one for hot tank and one for cold tank) may be used. This is HTS/CTS Setpoint Control; see **Piping** and **Operation** chapters for details.

Setpoint Control: Aux. Connections

When using Setpoint Control, hydronic auxiliary heat is activated with a 24VAC signal from DO_2 (HYD_AUX) on the left side of control board.

go to TABLE OF CONTENTS

This powers the coil of an external contactor to operate hydronic auxiliary heat. **This signal can provide a maximum of 500mA at 24VAC.** If using an auxiliary heating device with its own controller and transformer that requires dry contacts to activate, a relay with 24VAC coil must. be added.

TABLE 6 - Setpoint Control: Aux. Connections	
Signal	**Description**
LC	**24VAC common (ground)**
DO_2	**Hydronic Auxiliary (hot)**
Use a 2-conductor 18ga cable.	

Signals/Hardwired Control Connections

Most installations will use ***BACnet*** or the ***Setpoint Control*** routine to control buffer tank temperature, in which case no aquastat is required. However, an aquastat or aquastats can be used if required, for example if heating two loops with different setpoint temperatures, or using a time-of-day or other third-party programmable controller. This is ***Signals*** or ***Hardwired Control***.

The **CA, RA, Y1A , Y2A,** and **O** connections are located on the right side towards the top of the control board, as shown on the wiring diagram in the **Model Specific Information** chapter. The external device needs to send the 24VAC signal from **RA** back to the **Y1A** terminal to call for compressor 1, to the **Y2A** terminal to call for compressor 2, and to **O** to select cooling mode (reversing HAC models only). **CA** is the common or auxiliary heat. When using Hardwired Control, a mechanical tank element thermostat can be set to maximum, allowing the electric elements to be controlled by an external contactor placed in the power supply connections; the contactor can be connected to stage 2 of the heating aquastat via an optional 0-2hour timer. Or if the tank has an electronic controller, it can be set to run according to its own setpint, which should be set lower than that of the heat pump. Diagram **002069CDG** show a typical wiring setup for zones, zone circulator, and hydronic auxiliary for a heating only system.

TABLE 7 - Signals Control Connections	
Signal	**Description**
CA	**24VAC common (ground)**
RA	**24VAC hot**
O*	**Cooling mode (reversing valve both stages)***
Y1A	**Compressor #1 (bottom)**
Y2A	**Compressor #2 (top)**
*** HAC models only**	

The following tables show typical settings for the aquastats. With these settings, stage 1 will activate when the tank temperature reaches the activation point. If the load is too great, the tank temperature will continue to drop when heating until stage 2 is activated. As the tank temperature stops dropping and begins to increase when heating, stage 2 will turn off before stage 1, rather than at the same time as stage 1. There are three main advantages to this:

- Less aquastat probe lag leading to reduced overshoot as the tank temperature rate of change is reduced when only stage 1 is active.
- Prolonged stage 1 runtime leads to increased efficiency.
- Reduced number of compressor starts.

The settings may be changed as desired; however stage 1 setpoint for heating should not exceed **130°F (54°C)** for W-series and **160°F (71°C)** for WH-series; stage 1 cooling setpoint should not be set below **43°F (6°C)** for W-series and **45°F (7°C)** for WH-series. Exceeding these setpoint limits will cause the heat pump operating pressures to approach the safety control settings, possibly causing nuisance shutdowns.

If only floor zones are being heated, it is highly recommended to drop each of the heating setpoints by 15°F (8°C) for increased efficiency.

A buffer tank with electric elements can be used to provide auxiliary heat.

Note that for reversing models in cooling mode, it is important to choose zone thermostats or other control devices that continuously send an "O" signal, even when there is no cooling demand. This is to avoid repeated heating and cooling of the buffer tank on demand cycling, causing temperature lags and high electricity consumption.

TABLE 8a - Typical W-Series Aquastat Settings						
HEATING	**Stage 1 (aquastat)**		**Stage 2 (aquastat)**		Stage 3 (tank controller)	
	°F	°C	°F	°C	°F	°C
Setpoint	**108**	***42***	**105**	***41***	100	*38*
Delta	**8**	***4***	**8**	***4***	8	*4*
Activation *	100	*38*	97	*37*	92	*34*
Delay					**10 minutes**	
COOLING	**Stage 1**		**Stage 2**		*Activation is determined by the Setpoint and Delta values	
	°F	°C	°F	°C		
Setpoint	**45**	***7***	**48**	***9***		
Delta	**8**	***4***	**8**	***4***		
Activation *	53	*11*	56	*13*		

TABLE 8b - Typical WH-Series Aquastat Settings						
HEATING	**Stage 1 (aquastat)**		**Stage 2 (aquastat)**		Stage 3 (tank controller)	
	°F	°C	°F	°C	°F	°C
Setpoint	**150**	***66***	**147**	***64***	130	*54*
Delta	**8**	***4***	**8**	***4***	20	*10*
Activation *	142	*62*	139	*60*	110	*44*
Delay					**10 minutes**	
COOLING	**Stage 1**		**Stage 2**		*Activation is determined by the Setpoint and Delta values	
	°F	°C	°F	°C		
Setpoint	**45**	***7***	**48**	***9***		
Delta	**8**	***4***	**8**	***4***		
Activation *	53	*11*	56	*13*		

Disable Switch (field installed)

A switch or dry contact to disable demand from the control system may be installed. On control board, jumper **COM_IN** to **GND**, and toggle **12VDC** to **IN_SPARE** to disable. See wiring diagrams in the **Model Specific Information** chapter.

Other Connections

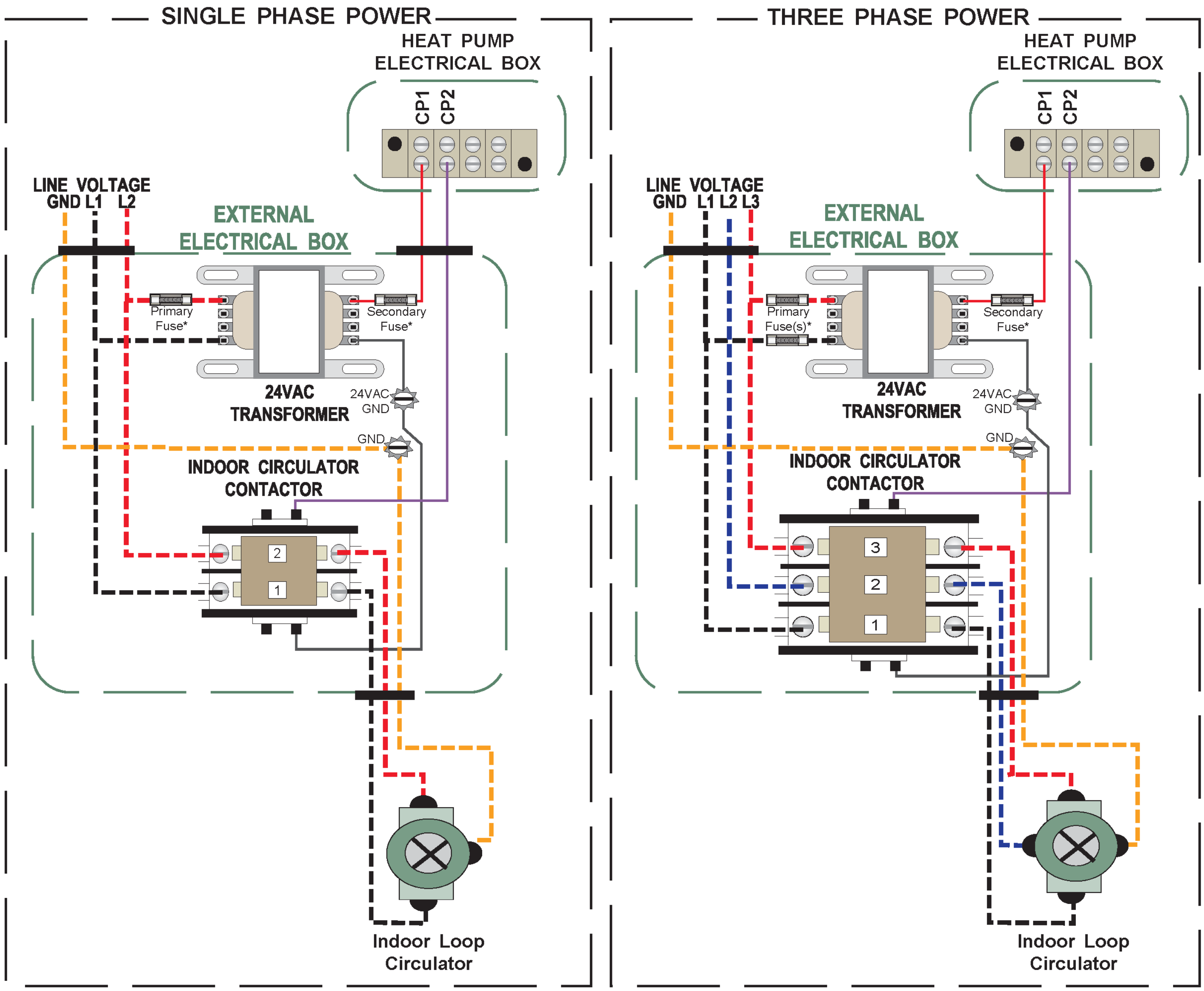
An accessory outdoor temperature sensor is available, to enable Setpoint Control's Outdoor Reset functionality.

Dry contacts to separately indicate stage 1 and stage 2 alarms are available, as is an "**L**" 24VAC trouble indicator signal.

See wiring diagram in the **Model Specific Information** chapter for details.

go to TABLE OF CONTENTS

Typical Indoor Circulator Connections for Commercial W Models using GEN2 Setpoint Control



NOTES:

1. Verify the line voltages are correct for the primary of the transformer and for the floor circulator.

2. Ensure that the transformer is sized to handle the load.

3. Priramy fuse(s) required depending on transformer size and primary voltage. Check local codes.

4. Secondary fuse required unless transformer has internal fuse or breaker

01	Initial Release	Chris Geddes	Chris Geddes	04 NOV 2016
REV	ECO #	IMPL BY	APVD BY	DATE

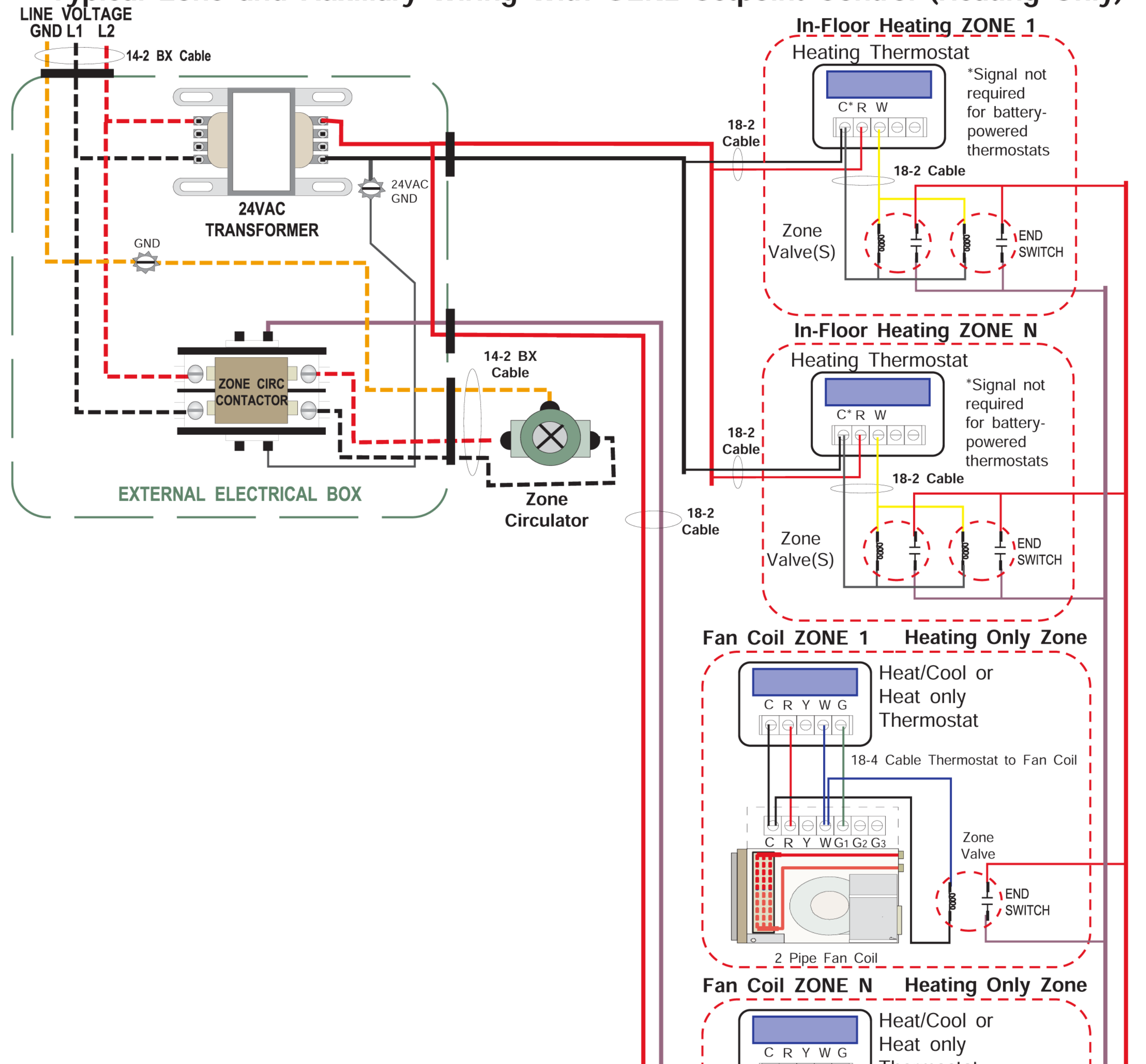
Drawn By Chris Geddes	Date 04 NOV 2016
Checked By Chris Geddes	Date 04 NOV 2016
Approved By (ENG) Chris Geddes	Date 04 NOV 2016
Approved By (MFG)	Date
Approved By	Date

MARITIME GEOTHERMAL LTD.

170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name	Commercial W Typical ICR Connections for GEN2 Setpoint Control		
Size A	Drawing Number 002188CDG	Drawing Rev 01	Sheet 1 of 1

Typical Zone and Auxiliary Wiring With GEN2 Setpoint Control (Heating Only)



NOTES:

1. Verify the line voltages are correct for the primary of the transformer and zone circulator(s).
2. Ensure that the transformer is sized to handle the load with all zones calling for heat. Zone valves can consume up to 15VA each.
3. Two pipe fan coils are recommended for fan coil zones.
4. Zone N indicates the last zone in the zone type.

THERMOSTAT FOR FAN COIL:

C	- Common (Internal Transformer)	G1	- Fan Speed 1
R	- 24VAC (Internal Transformer)	G2	- Fan Speed 2 (if equipped)
W	- Zone Valve	G3	- Fan Speed 3 (if equipped)
G	- Fan Signal, connect to::		(Select one fan speed)

02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
01	Initial Release	C. GEDDES	C. GEDDES	04-APR-2017
REV	ECO #	IMPL BY	APVD BY	DATE

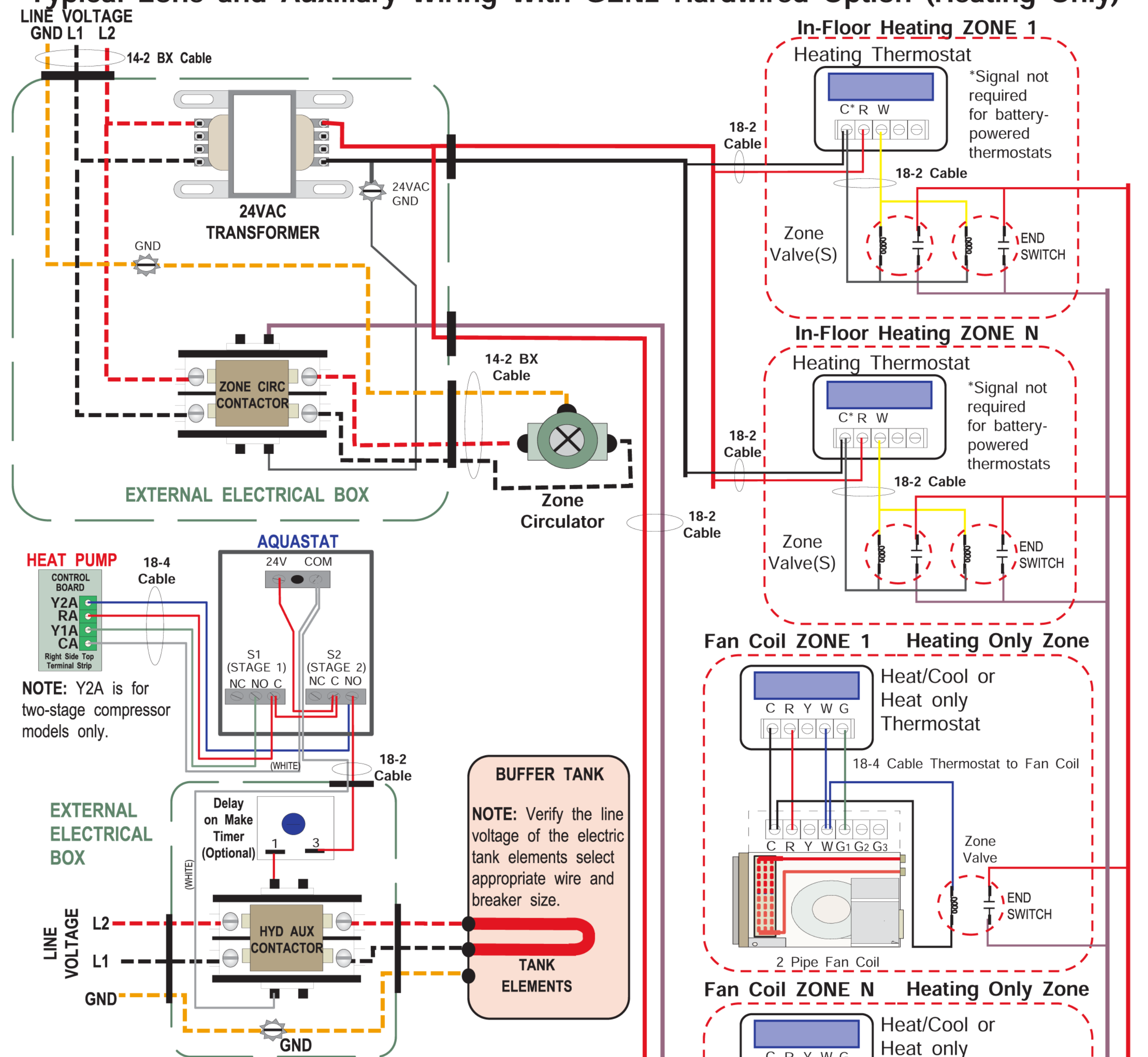
Drawn By C. Geddes	Date 04-APR-2016
Checked By C. Geddes	Date 04-APR-2016
Approved By (ENG) C. Geddes	Date 04-APR-2016
Approved By (MFG)	Date
Approved By	Date

MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4

Drawing Name	Typical Zone and Auxiliary Wiring With GEN2 Setpoint Control (Heating Only)		
Size	Drawing Number	Drawing Rev	Sheet
A	002067CDG	02	1 of 1

go to TABLE OF CONTENTS

Typical Zone and Auxiliary Wiring With GEN2 Hardwired Option (Heating Only)



NOTES:

1. Verify the line voltages are correct for the primary of the transformer and zone circulator(s.)

2. Ensure that the transformer is sized to handle the load with all zones calling for heat. Zone valves can consume up to 15VA each.

3. Two pipe fan coils are recommended for fan coil zones.

4. Zone N indicates the last zone in the zone type.

THERMOSTAT FOR FAN COIL:

C - Common (Internal Transformer)
R - 24VAC (Internal Transformer)
W - Zone Valve
G - Fan Signal, connect to::

G1 - Fan Speed 1
G2 - Fan Speed 2 (if equipped)
G3 - Fan Speed 3 (if equipped)
(Select one fan speed)

REV	ECO #	IMPL BY	APVD BY	DATE
02	000253	D. RHEAULT	D. RHEAULT	01-JUL-2017
01	Initial Release	C. GEDDES	C. GEDDES	04-APR-2017

Drawn By C. Geddes	Date 04-APR-2016
Checked By C. Geddes	Date 04-APR-2016
Approved By (ENG) C. Geddes	Date 04-APR-2016
Approved By (MFG)	Date
Approved By	Date

MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4

Size	Drawing Number	Drawing Rev	Sheet
A	002069CDG	02	1 of 1

Drawing Name: Typical Zone and Auxiliary Wiring With GEN2 Hardwired Option (Heating Only)

go to TABLE OF CONTENTS

Piping & Loop Information

Water Loop Connections

The **Outdoor Loop (Supply)** and **Indoor Loop (Hot)** connections are stainless steel pipe designed for Victaulic connectors. The connection sizes are shown in the following table. Piping should be done as per the system piping diagram as well as local codes. It is recommended that all piping be insulated to prevent condensation. All piping connected to the unit must be sufficiently externally supported so as not to strain the heat exchanger connections.

To avoid fouling of the brazed plate heat exchangers, a **strainer is required** on each loop IN connection. The strainer should be specified to stop particles larger than 1 mm, and corresponds to a mesh size of 16-20 depending on wire diameter. For closed loops, the strainer may be able to be removed after startup and commissioning is complete and a cleaned filter shows no removed particles after 1 week of operation.

Each port has a temperature sensor. The output is shown on the LCD Interface on the unit and may also be viewed via the PC APP. There is also a P/T port installed in each line, for measuring pressure drop for flow rate estimation. Both of the “**OUT**” ports have a flow switch on reversing models; only on the outdoor loop for non-reversing models.

Buffer tank sizing should be as per the engineering specifications for the jobsite. However, **the minimum buffer tank size should follow the rule of 8 US gallons per ton of heat pump capacity to avoid problems with short-cycling the heat pump(s)**. The table shows the minimum buffer tank size for each heat pump along with the recommended size. The recommended size will provide longer runtimes and fewer starts for improved efficiency.

IMPORTANT NOTE: Units are shipped configured for water for both the indoor and the outdoor loop. This prevents the heat exchangers from freezing when a low pressure alarm occurs regardless of the fluid type and mixture in the system loops. During startup the fluid type and mixture for both the indoor and outdoor loop must be configured via the PC APP using the Tools - Configuration menu. (There is no need for antifreeze with WH-series due to source temperature limitation of 45°F / 7°C.)

WARNING: ENSURE FLUID TYPE SETTING ARE ACCURATE. FAILURE TO DO SO COULD CAUSE THE HEAT EXCHANGER TO FREEZE AND RUPTURE, DESTROYING THE HEAT PUMP AND VOIDING THE WARRANTY.

WARNING: REPEATED RESETS OF A LOW PRESSURE LOCKOUT COULD CAUSE THE HEAT EXCHANGER TO FREEZE AND RUPTURE, DESTROYING THE HEAT PUMP AND VOIDING THE WARRANTY.

Headers for Multiple Units

Horizontal headers with equally spaced side connections for multiple units may be fabricated by the mechanical contractor (the usual practice), or ordered with the heat pumps. In either case, detailed plans and a list of required accessories (strainers, valves) must be provided.

The header pipe must have at least the capacity of all the heat pump connections combined. See the following table for minimum header sizes.

TABLE 9 - Loop Connection Sizes

Model Size	Connection Size (SS grooved/Victaulic)
150	2” (51 mm)
185	
240	
300	
400	
500	3” (76 mm)
600	
800	
900	
1000	

TABLE 10 - Horizontal Header Size for Multiple Units

Number of Heat Pumps	Heat Pump Connection Size	Min. Nominal SCH40 Pipe Size for Header
2	2” (51 mm)	3”
	3” (76 mm)	5”
3	2” (51 mm)	4”
	3” (76 mm)	6”
4	2” (51 mm)	5”
	3” (76 mm)	8”
5	2” (51 mm)	5”
	3” (76 mm)	8”
6	2” (51 mm)	6”
	3” (76 mm)	8”
7	2” (51 mm)	6”
	3” (76 mm)	10”
8	2” (51 mm)	6”
	3” (76 mm)	10”

TABLE 11 - Buffer Tank Size

Heat Pump Size	Minimum Size gal (L)	Recommended Size gal (L)
150	100 (380)	120 (450)
185	130 (500)	180 (680)
240	160 (600)	200 (750)
300	200 (750)	250 (950)
400	250 (950)	300 (1100)
500	320 (1200)	400 (1500)
600	400 (1500)	500 (1900)
800	520 (2000)	600 (2300)
900	560 (2100)	600 (2300)
1000	648 (2450)	800 (3000)

go to TABLE OF CONTENTS

Ground Loop Systems

Note that in northern climates, **only the W-series** is suitable for use with a closed ground loop (**WH** is generally not suitable due to its minimum required source temperature of **45°F/7°C**).

Commercial ground loop design is beyond the scope of this manual, and is normally performed by mechanical consulting engineering firms. For concept stage planning, it may be considered that approximately one vertical loop of 150 ft depth per nominal ton of heat pump capacity will be required; or there can be a smaller number of deeper wells. Note that a different borehole length per ton may be required if ground conductivity or load balance vary from the average, and that due to the cost of a commercial installation, a test well to measure ground conductivity is often drilled before ground loop design is finalized. Loops must be placed far enough apart to avoid excessive thermal interference, e.g. 20 ft / 6 m apart. Loops are normally headered together underground, with care taken to size the headers properly so that purging of air is possible with reasonably sized pumping equipment.

Note that adequate freeze protection for the loop fluid is required. The proper type and quantity of antifreeze must be added to the ground loop as per the system design.

WARNING: It is recommended that enough antifreeze be added to allow for a temperature 20°F (11°C) lower than the expected lowest loop fluid temperature entering the heat pump.

It is important to size ground loop circulation pumps to deliver the required flow as listed in the table in the **Model Specific Information** chapter, considering the expected pressure drop of the antifreeze mixture used through the heat pumps and ground loop and all accessories. Low flow rate due to undersized circulation pumps causing low heat pump performance or safety control trips is a common problem when commercial projects are commissioned.

Once the antifreeze solution has been added to the ground loop and all air has been purged from the system, the entire ground loop can be pressurized to the appropriate value as per the system design requirements. If possible, the ground loop circulators should be tested prior to starting the heat pump to ensure that the loop is functioning properly.

Open Loop Systems

The temperature of the well water for open loop installations should be a minimum of **42°F (6°C)** for the W-series and **45°F (7°C)** for the WH-series. Refer to the **Model Specific Information** chapter for a complete table of temperature operation limits.

Discharge water from the heat pump should be disposed of as per the system piping diagram and local codes. Most commonly, a return well will be required.

Open loop systems will require an ON/OFF or modulating water valve to shut off the water flow when heat pump is not running.

Water Quality Guidelines

The well water should be tested to be sure it meets minimum standards. Poor water quality can lead to rapid heat exchanger failure or frequent servicing.

The well should not produce any sand. Sand will physically erode heat exchanger surfaces, and quickly clog return (injection) wells. **Solids** or **TDS** should be less than **1 ppm (1 mg/L)** if a return well is used.

To avoid scale formation on the inside of the heat pump's outdoor loop coil, total **hardness** should be less than **350 ppm / 350 mg/L**. In practice, scaling is very rarely a problem at northern groundwater temperatures of 50°F or less because scale does not generally form at low well water temperatures (unlike, for example, in a domestic hot water tank). In more southern climates, the hardness guideline will be a more important consideration. Should scale form, heat pump performance will gradually deteriorate, and will require periodic flushing with a calcium/lime removing solution (see **Routine Maintenance**).

Corrosive (salty) water is a concern, since although the brazed plates are made of corrosion-resistant 316SS, the copper brazing is susceptible to attack by chlorides. The water should be tested and fall within the limits in the following table. If it doesn't, the use of an open loop system should be reconsidered.

TABLE 12 - Water Quality Limits

Water Property	Should be
Chlorides	< 300 ppm
pH	> 7.5
Ammonia (NH_3)	< 2 ppm
Hydrogen Sulfide (H_2S)	< 0.05 ppm
Sulfate (SO_4^{2-})	< 70 ppm
Solids (TDS)	< 1 ppm
Hardness	< 350 ppm

Note that mg/L = ppm, and see notes above table.

Modulating Water Valve

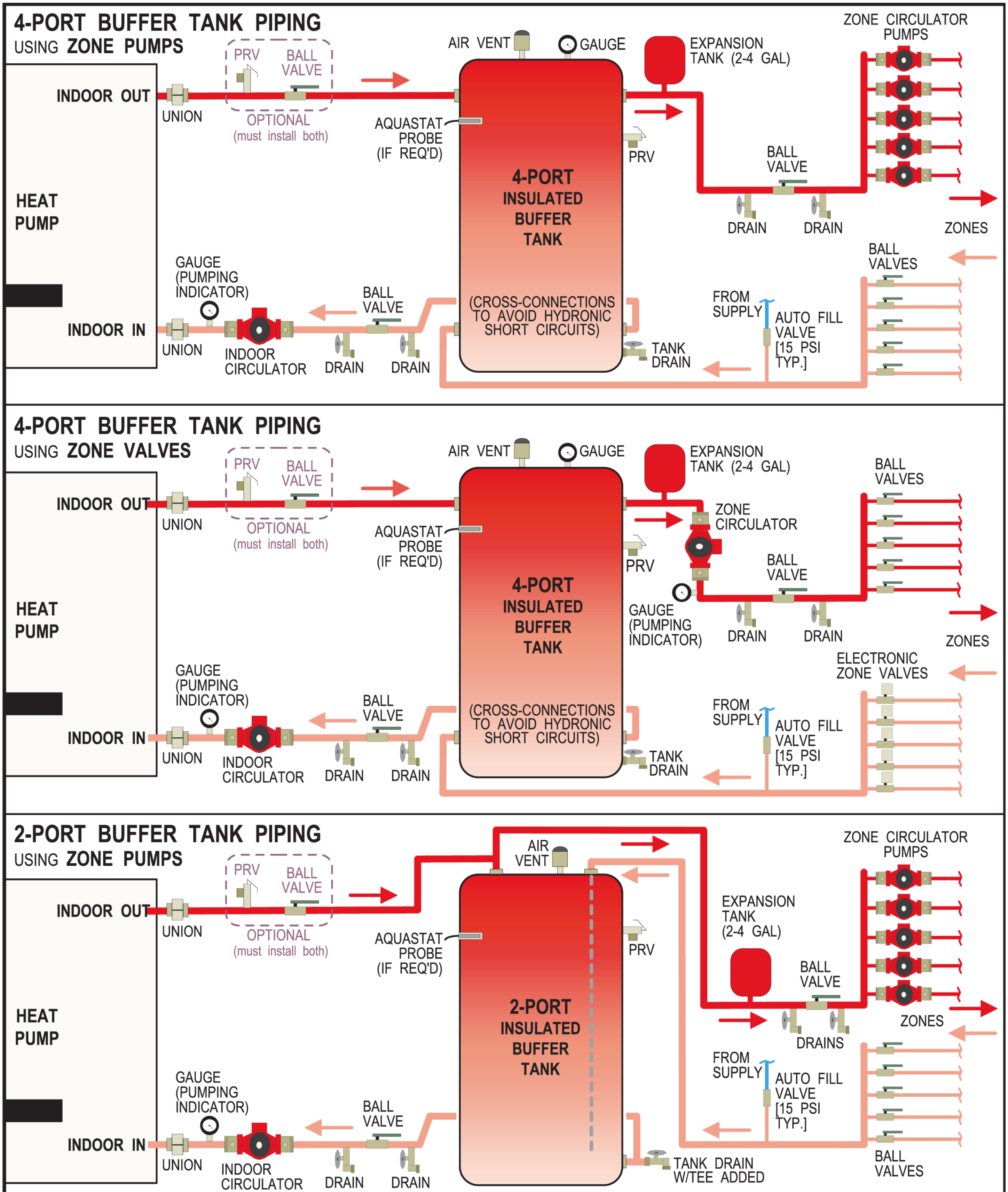
A 0-10VDC modulating motorized water valve controlled by the Gen2 control board in the heat pump may be required on the indoor or outdoor loops depending on transient or steady state loop operating temperatures. See **Wiring** chapter, and the ***Operating Temperature Limits*** table in the **Model Specific Information** chapter.

The modulating water valve is available as an accessory from Maritime Geothermal Ltd., and can be installed on either the loop's IN or OUT connections at the heat pump. Depending on size, valve connections may be **threaded** or **flanged**, and two grooved (Victaulic) adapters should be used per valve.

Note that where installed, the modulating water valve will act as the water shutoff valve, and no additional solenoid valve is required.

CAUTION: if a modulating water valve is not installed where its use is indicated, nuisance low pressure control trips may occur.

go to TABLE OF CONTENTS



REV	ECO #	IMPL BY	APVD BY	DATE
02	(add fill valve)	D. RHEAULT	D. RHEAULT	1-Feb-2021
01	Initial Release	D. RHEAULT	D. RHEAULT	14-Dec-2018

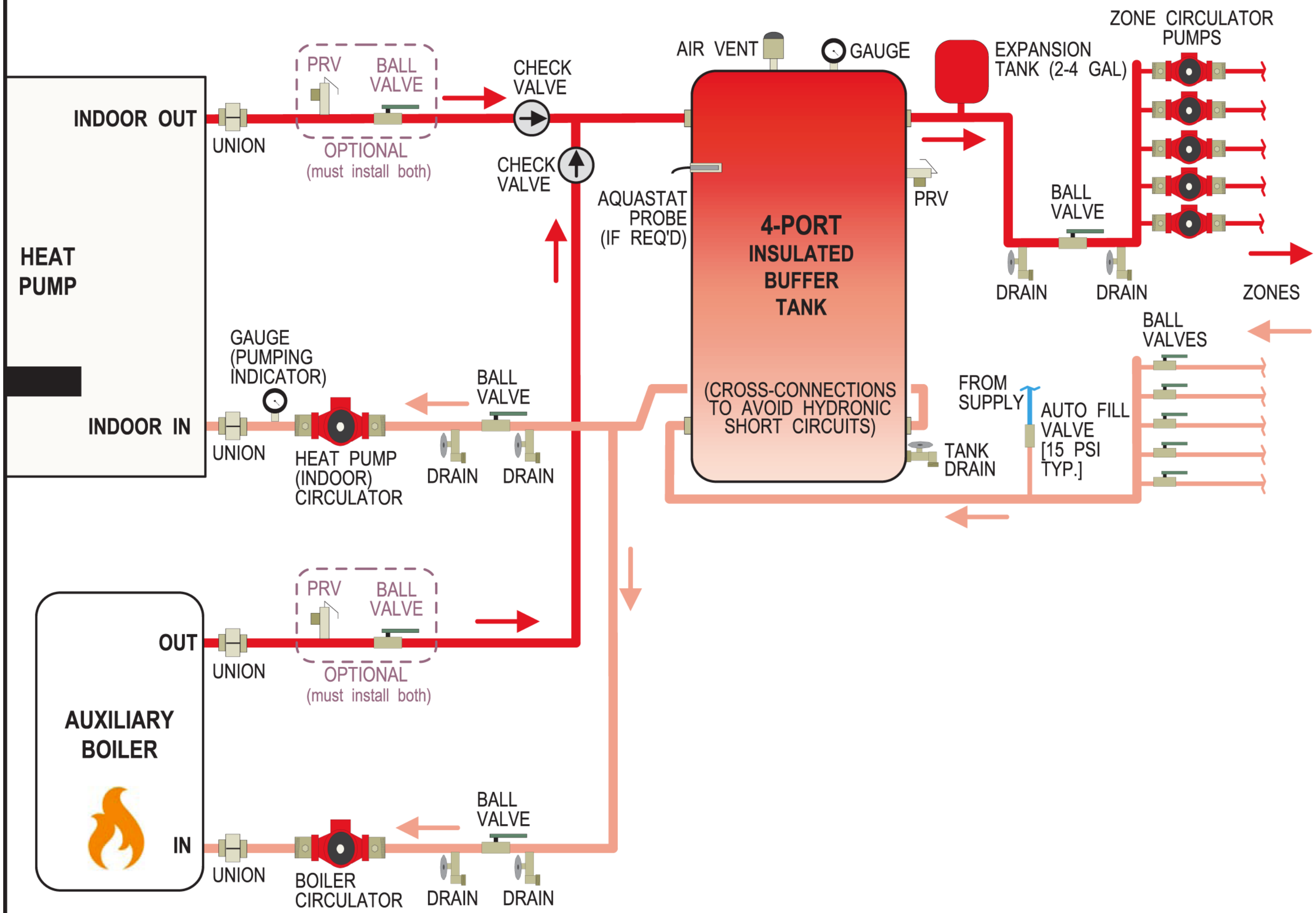
Drawn By Dan Rheault	Date 14-Dec-2018	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
Checked By Dan Rheault	Date 14-Dec-2018	Drawing Name: Recommended Hydronic Buffer Tank Piping
Approved By (ENG)	Date	
Approved By (MFG)	Date	Size: A; Drawing Number: 002366PDG; REV: 02; SHEET: 1 of 1
Approved By	Date	

go to TABLE OF CONTENTS

Auxiliary Boiler Piping

NOTE: CHECK VALVES SHOULD BE SPRING TYPE, OTHERWISE UNINTENDED FLOW MAY OCCUR. SIZE CIRCULATORS INCLUDING PRESSURE DROP THROUGH SPRING CHECK VALVES.

SYSTEM WITH 4-PORT TANK & ZONE PUMPS SHOWN; SEE DIAGRAM **002366PDG** FOR SYSTEM USING 2-PORT TANK OR ZONE VALVES.



USING THIS PARALLEL ARRANGEMENT, BOILER MAY OPERATE ALONE (TO PROVIDE BACKUP HEAT) OR IN CONJUNCTION WITH HEAT PUMP (TO PROVIDE AUXILIARY HEAT).

BOILER MUST BE CONTROLLED AS 3RD STAGE OF HEAT BY HEAT PUMP CONTROL BOARD OR EXTERNAL CONTROLLER. BOILER MAY THEN OPERATE AT A HIGHER OUTPUT TEMPERATURE THAN HEAT PUMP WITHOUT CAUSING HIGH TEMPERATURE/HIGH PRESSURE PROBLEMS AT THE HEAT PUMP.

02	(add fill valve)	D. RHEAULT	D. RHEAULT	1-Feb-2021
01	Initial Release	D. RHEAULT	D. RHEAULT	14-Dec-2018
REV	ECO #	IMPL BY	APVD BY	DATE

Drawn By Dan Rheault	Date 14-Dec-2018
Checked By Dan Rheault	Date 14-Dec-2018
Approved By (ENG)	Date
Approved By (MFG)	Date
Approved By	Date

MARITIME GEOTHERMAL LTD.

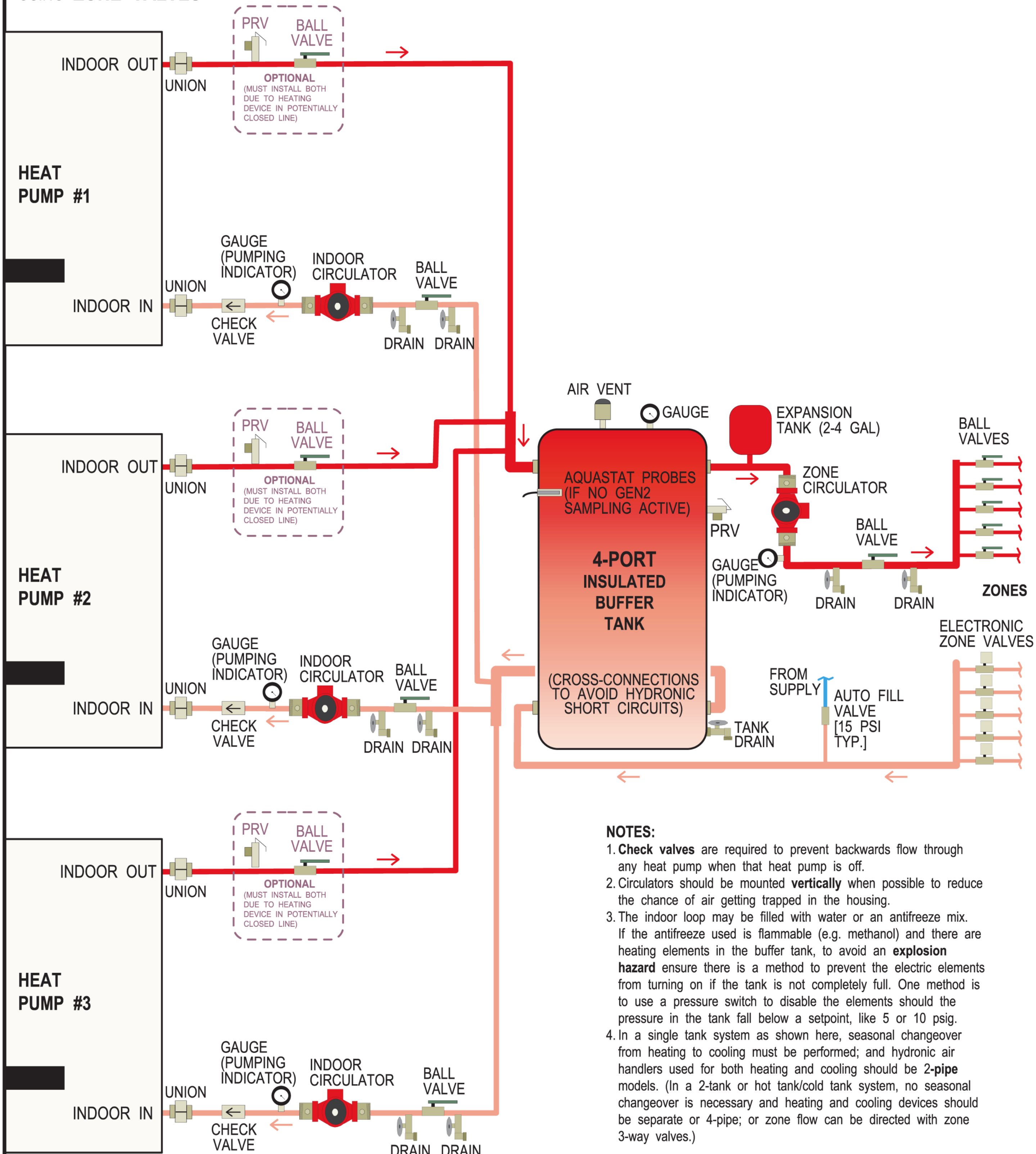
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: **Auxiliary Boiler Piping**

Size	Drawing Number	REV	SHEET
A	002367PDG	02	1 of 1

go to TABLE OF CONTENTS

4-PORT BUFFER TANK PIPING FOR MULTIPLE HEAT PUMPS
USING **ZONE VALVES**



NOTES:

1. **Check valves** are required to prevent backwards flow through any heat pump when that heat pump is off.
2. Circulators should be mounted **vertically** when possible to reduce the chance of air getting trapped in the housing.
3. The indoor loop may be filled with water or an antifreeze mix. If the antifreeze used is flammable (e.g. methanol) and there are heating elements in the buffer tank, to avoid an **explosion hazard** ensure there is a method to prevent the electric elements from turning on if the tank is not completely full. One method is to use a pressure switch to disable the elements should the pressure in the tank fall below a setpoint, like 5 or 10 psig.
4. In a single tank system as shown here, seasonal changeover from heating to cooling must be performed; and hydronic air handlers used for both heating and cooling should be **2-pipe** models. (In a 2-tank or hot tank/cold tank system, no seasonal changeover is necessary and heating and cooling devices should be separate or 4-pipe; or zone flow can be directed with zone 3-way valves.)

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	D. RHEAULT	D. RHEAULT	9-Aug-2021

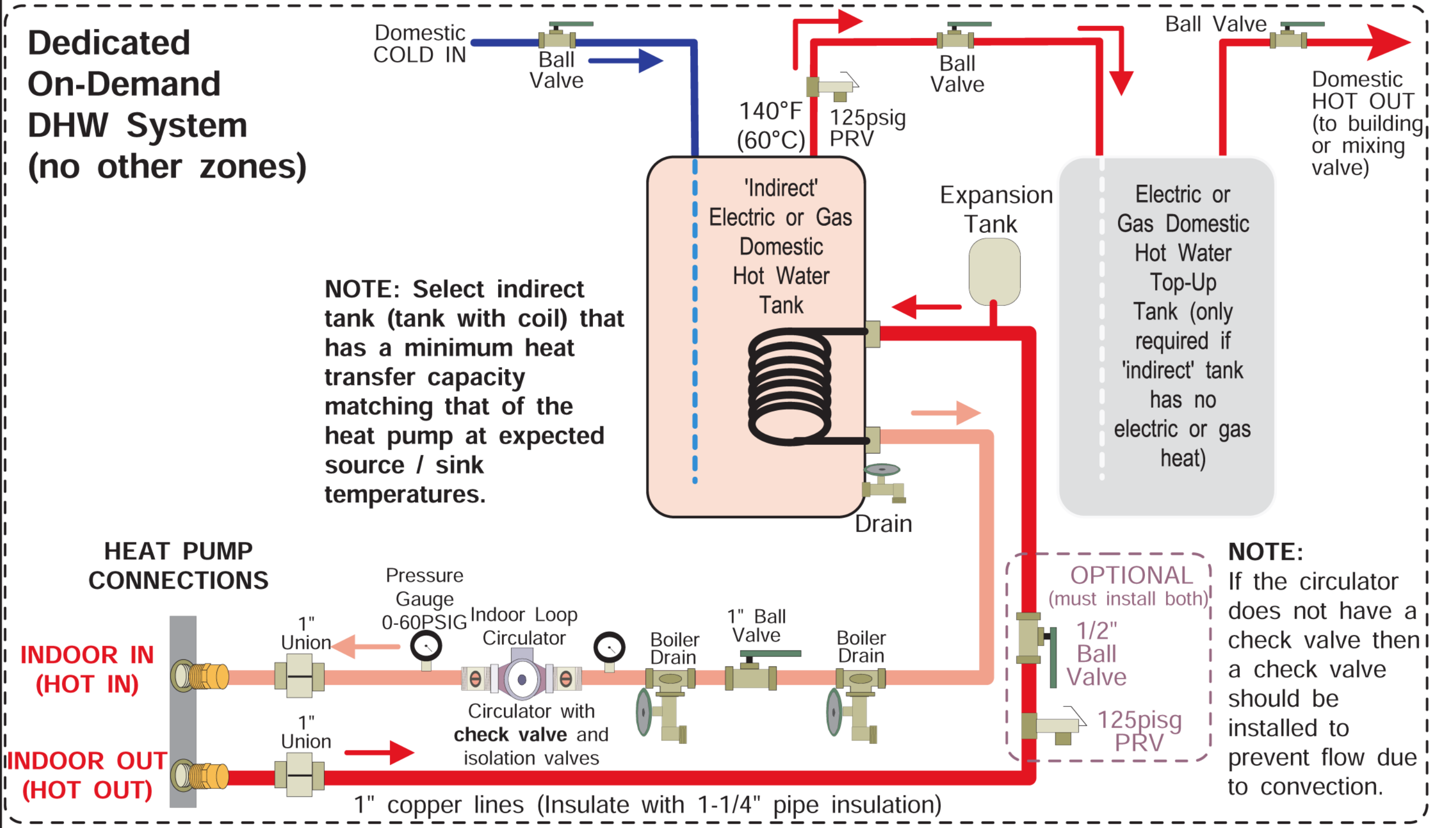
Drawn By Dan Rheault	Date 9-Aug-2021
Checked By Dan Rheault	Date 9-Aug-2021
Approved By (ENG)	Date
Approved By (MFG)	Date
Approved By	Date

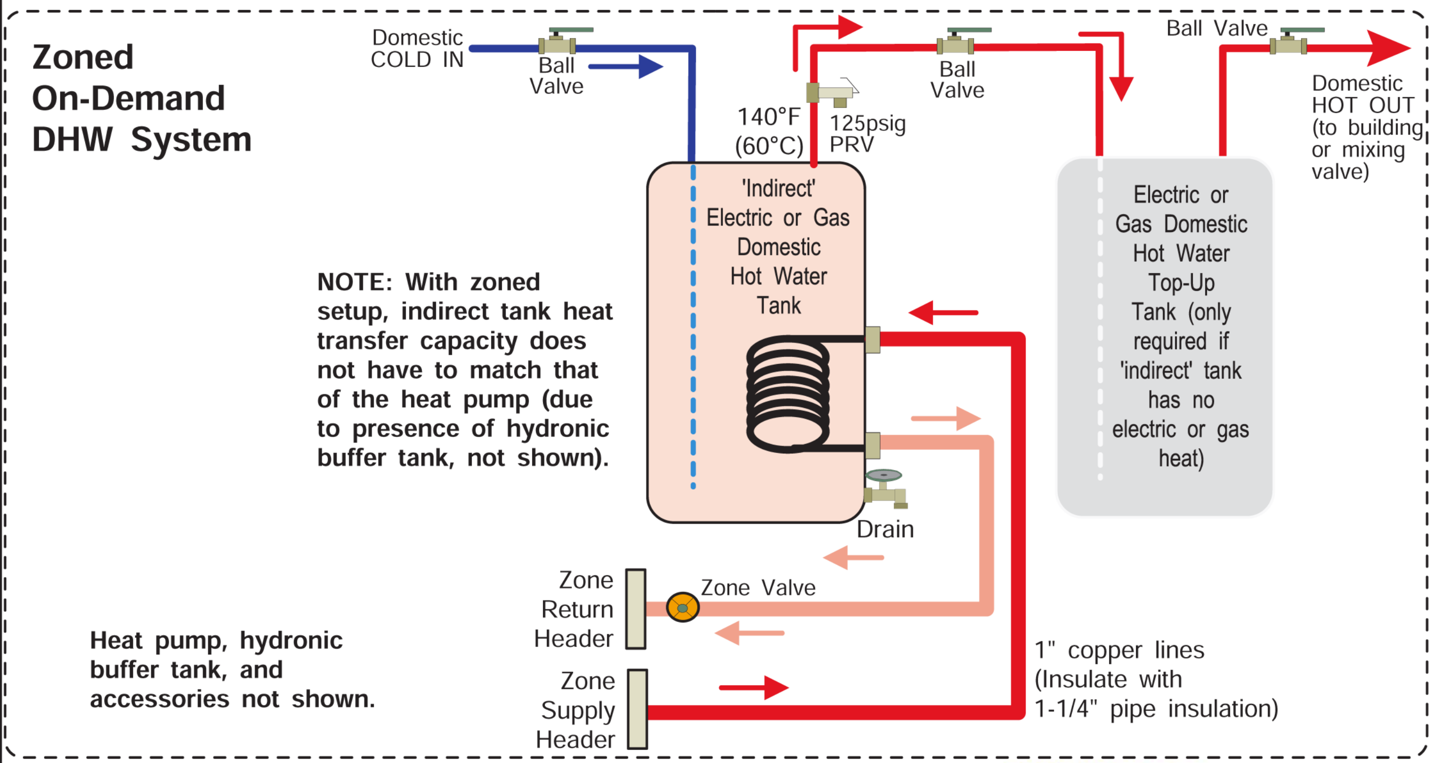
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name			
Buffer Tank Piping - Multiple Units			
Size	Drawing Number	REV	SHEET
A	002528PDG	01	1 of 1

go to TABLE OF CONTENTS

High Temperature Heat Pump *with Single Wall Condenser* : Dedicated Domestic Hot Water Heating



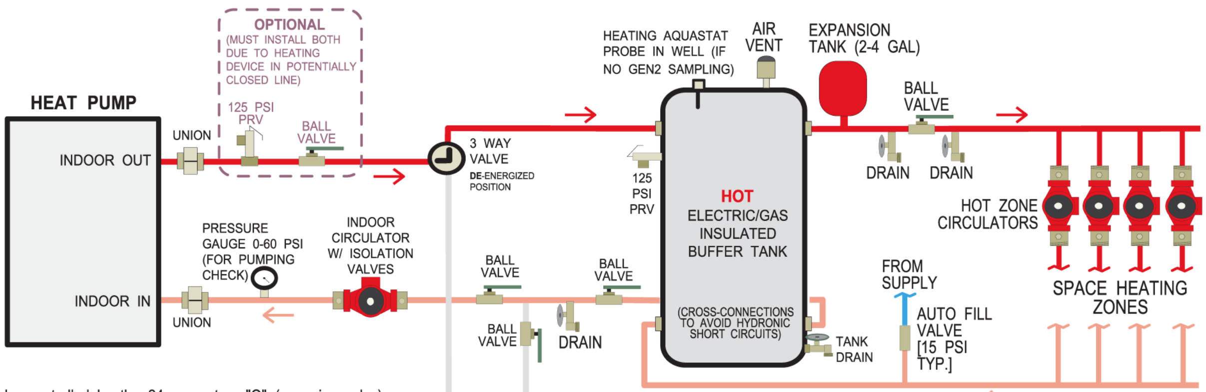


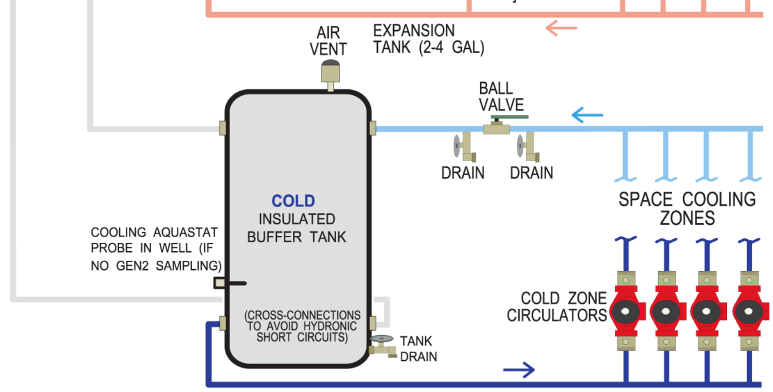
					Drawn By Dan Rheault	Date 1-Sep-2017	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
					Checked By Dan Rheault	Date 1-Sep-2017	Drawing Name: High Temperature Single Wall Unit Connection to DHW Tank
					Approved By (ENG) Dan Rheault	Date 1-Sep-2017	
					Approved By (MFG)	Date	
01	Initial Release	D. RHEAULT	D. RHEAULT	1-Sep-2017			Size: A; Drawing Number: 002240PDG; REV: 01; SHEET: 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By	Date	

go to TABLE OF CONTENTS

Two Tank System Piping with a Reversing Heat Pump

HEATING MODE

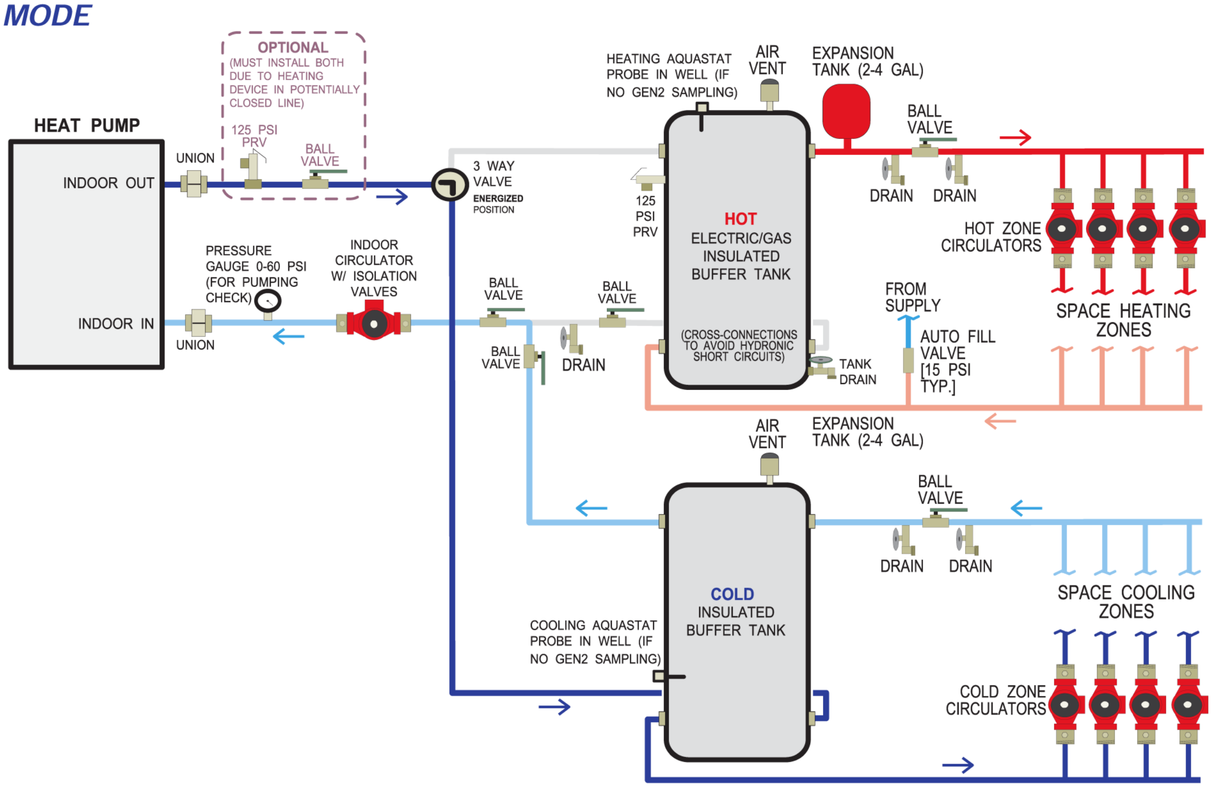




NOTES:

1. The 3-way valve can be controlled by the 24vac system "O" (reversing valve) signal, or TWO_TANK_3_WAY control board signal from the Gen2 heat pump (e.g. ATW-Series). The Gen2 2-TANK AUTO-MAINTAIN control method can be used so that no "O" signal is required and heat pump switches from heating to cooling automatically.
2. Circulators should be mounted **vertically** when possible to reduce the chance of air getting trapped in the housing.
3. The aquastat probe should be placed all the way in the dry well. The outside end of the well where the probe wire is should be well insulated. Not required if using the Gen2 control board's Setpoint Control sampling routine.
4. The loop may be filled with water or an antifreeze mix. If the antifreeze used is flammable (e.g. methanol), and there are heating elements in the buffer tank, ensure there is a method to prevent the electric elements from turning on if the tank is not completely full. One method is to use a pressure switch to disable the elements should the pressure in the tank drop below a setpoint, such as 5 or 10PSIG. Allowing the elements to come on when they are not fully submerged will burn the element out and **could cause an explosion.**
5. Hydronic air handlers used for both heating and cooling should be 4-pipe models.

COOLING MODE



REV	ECO #	IMPL BY	APVD BY	DATE
02	-	D. RHEAULT	D. RHEAULT	6-Aug-2021
02	-	D. RHEAULT	D. RHEAULT	1-Mar-2018
01	Initial Release	D. RHEAULT	D. RHEAULT	25-Oct-2017

Drawn By: Dan Rheault	Date: 25-Oct-2017
Checked By: Dan Rheault	Date: 25-Oct-2017
Approved By (ENG): Dan Rheault	Date: 25-Oct-2017
Approved By (MFG)	Date
Approved By	Date

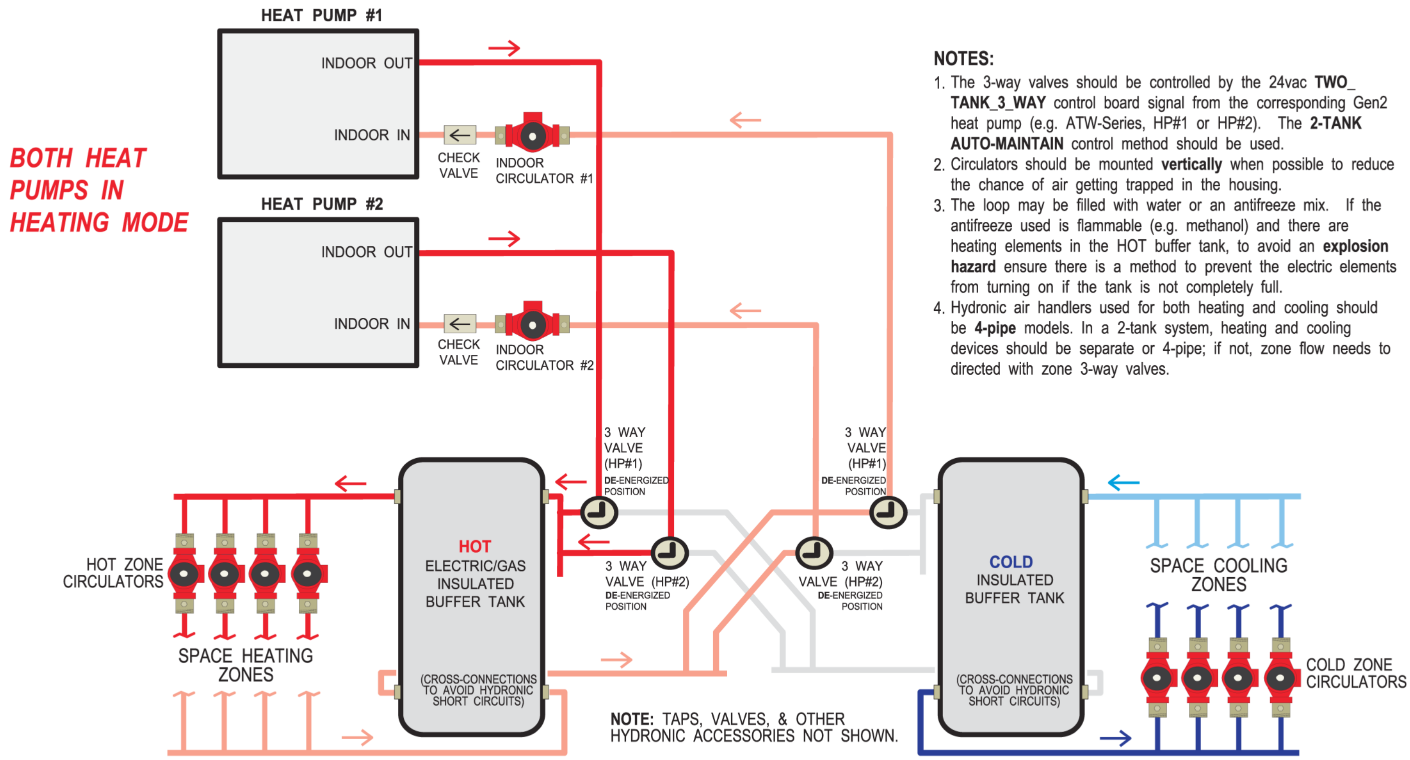
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Two Tank System Piping with a Reversing Heat Pump

Size	Drawing Number	REV	SHEET
A	002252PDG	03	1 of 1

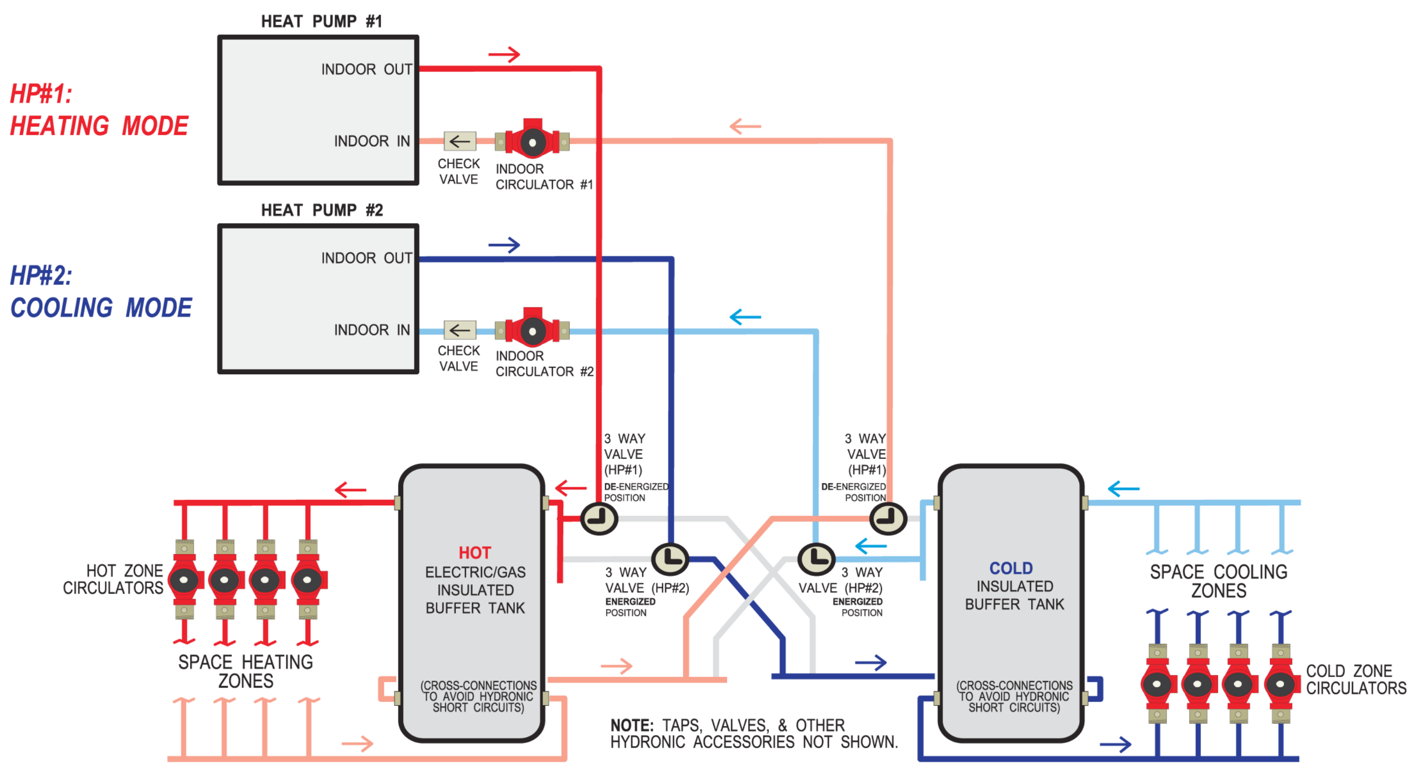
go to TABLE OF CONTENTS

Two Tank System Piping with Multiple Reversing Heat Pumps



NOTES:

1. The 3-way valves should be controlled by the 24vac **TWO_TANK_3_WAY** control board signal from the corresponding Gen2 heat pump (e.g. ATW-Series, HP#1 or HP#2). The **2-TANK AUTO-MAINTAIN** control method should be used.
2. Circulators should be mounted **vertically** when possible to reduce the chance of air getting trapped in the housing.
3. The loop may be filled with water or an antifreeze mix. If the antifreeze used is flammable (e.g. methanol) and there are heating elements in the HOT buffer tank, to avoid an **explosion hazard** ensure there is a method to prevent the electric elements from turning on if the tank is not completely full.
4. Hydronic air handlers used for both heating and cooling should be **4-pipe** models. In a 2-tank system, heating and cooling devices should be separate or 4-pipe; if not, zone flow needs to directed with zone 3-way valves.



01	Initial Release	D. RHEAULT	D. RHEAULT	6-Aug-2021
REV	ECO #	IMPL BY	APVD BY	DATE

Drawn By Dan Rheault	Date 6-Aug-2021
Checked By Dan Rheault	Date 6-Aug-2021
Approved By (ENG) Dan Rheault	Date 6-Aug-2021
Approved By (MFG)	Date
Approved By	Date

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name	Two Tank System Piping with Multiple Reversing Heat Pumps		
Size	Drawing Number	REV	SHEET
A	002527PDG	01	1 of 1

go to TABLE OF CONTENTS

Two Tank Simultaneous Heating / Cooling

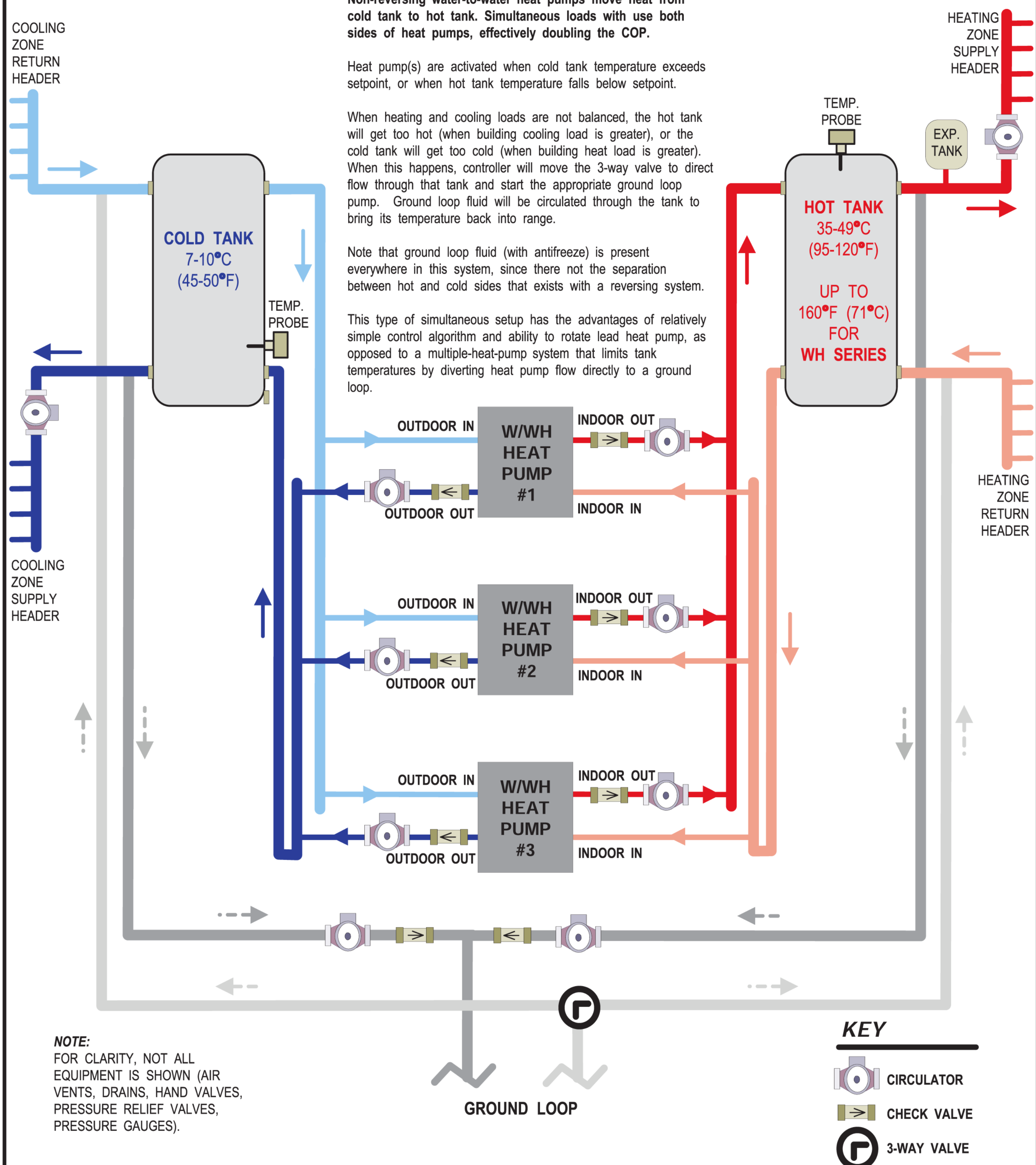
Non-reversing water-to-water heat pumps move heat from cold tank to hot tank. Simultaneous loads with use both sides of heat pumps, effectively doubling the COP.

Heat pump(s) are activated when cold tank temperature exceeds setpoint, or when hot tank temperature falls below setpoint.

When heating and cooling loads are not balanced, the hot tank will get too hot (when building cooling load is greater), or the cold tank will get too cold (when building heat load is greater). When this happens, controller will move the 3-way valve to direct flow through that tank and start the appropriate ground loop pump. Ground loop fluid will be circulated through the tank to bring its temperature back into range.

Note that ground loop fluid (with antifreeze) is present everywhere in this system, since there not the separation between hot and cold sides that exists with a reversing system.

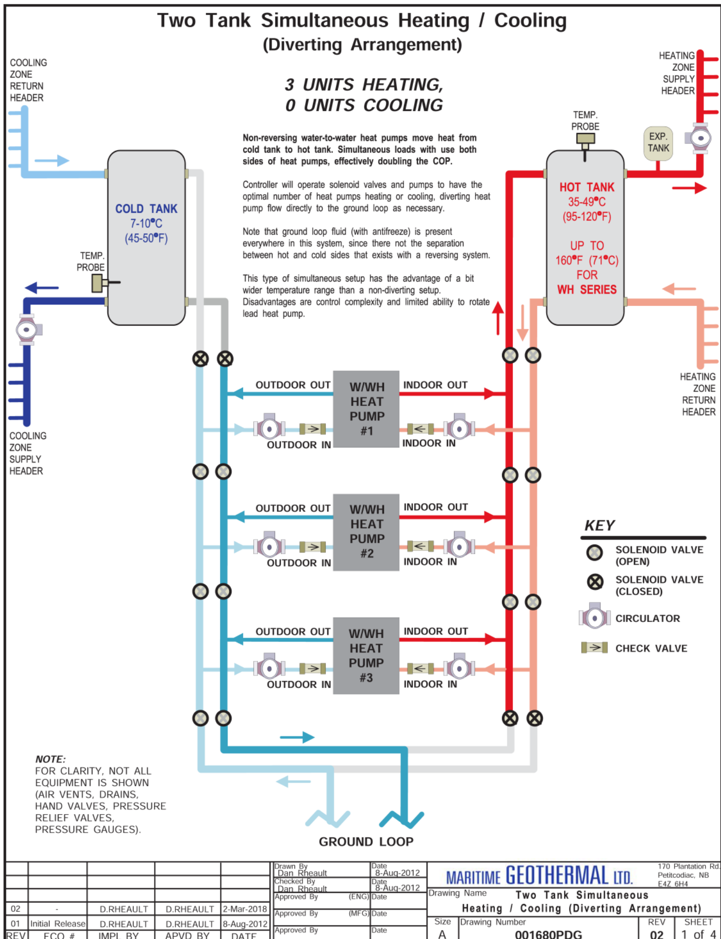
This type of simultaneous setup has the advantages of relatively simple control algorithm and ability to rotate lead heat pump, as opposed to a multiple-heat-pump system that limits tank temperatures by diverting heat pump flow directly to a ground loop.

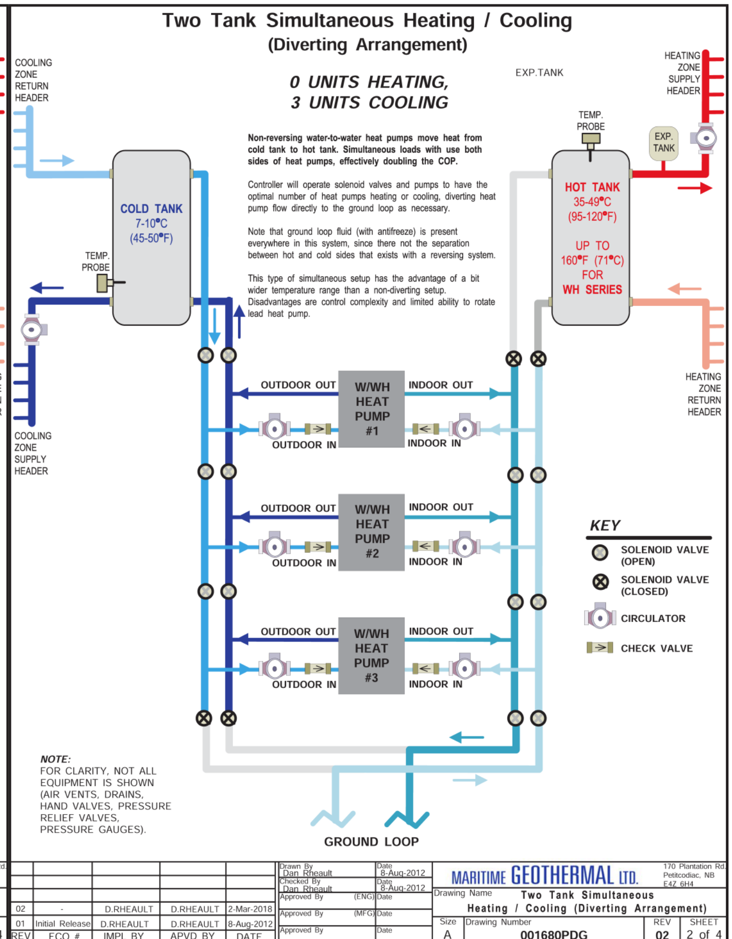


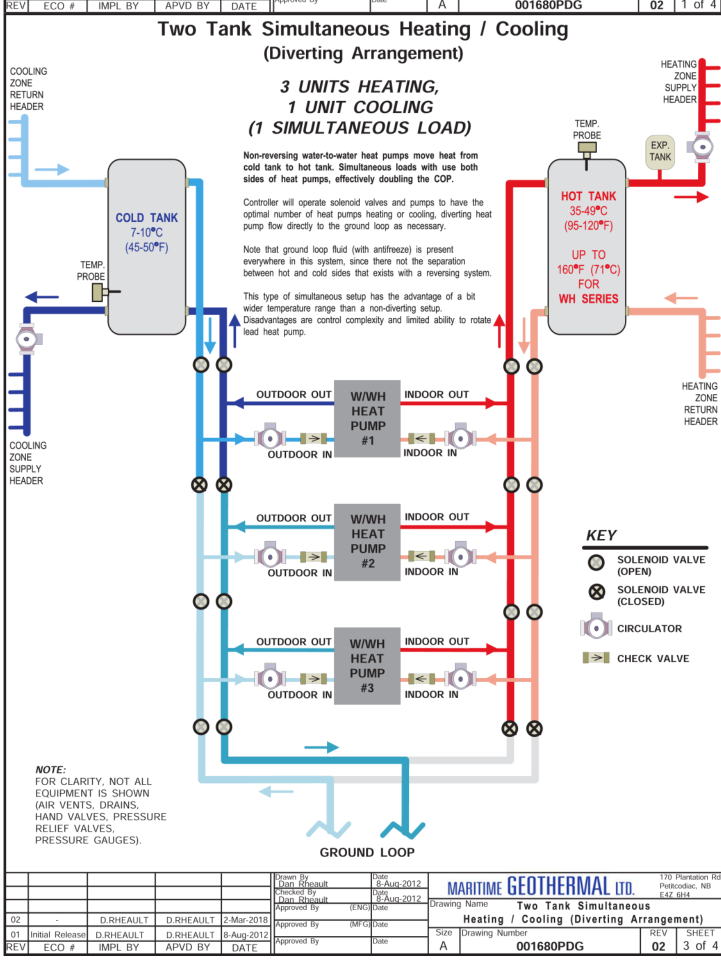
NOTE:
FOR CLARITY, NOT ALL EQUIPMENT IS SHOWN (AIR VENTS, DRAINS, HAND VALVES, PRESSURE RELIEF VALVES, PRESSURE GAUGES).

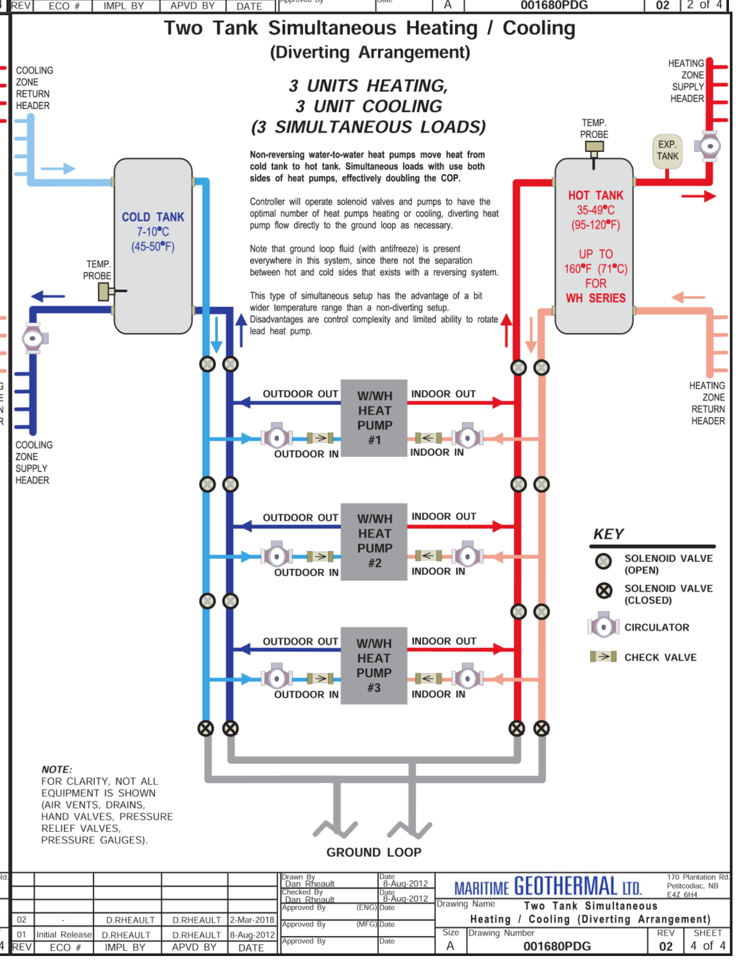
					Drawn By Dan Rheault	Date 2-Mar-2018	MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4
					Checked By Dan Rheault	Date 2-Mar-2018	Drawing Name: Two Tank Simultaneous Heating / Cooling
					Approved By (ENG)	Date	
01	Initial Release	D. RHEAULT	D. RHEAULT	2-Mar-2018	Approved By (MFG)	Date	Size: A — Drawing Number: 002288PDG — REV: 01 — SHEET: 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By	Date	

go to TABLE OF CONTENTS









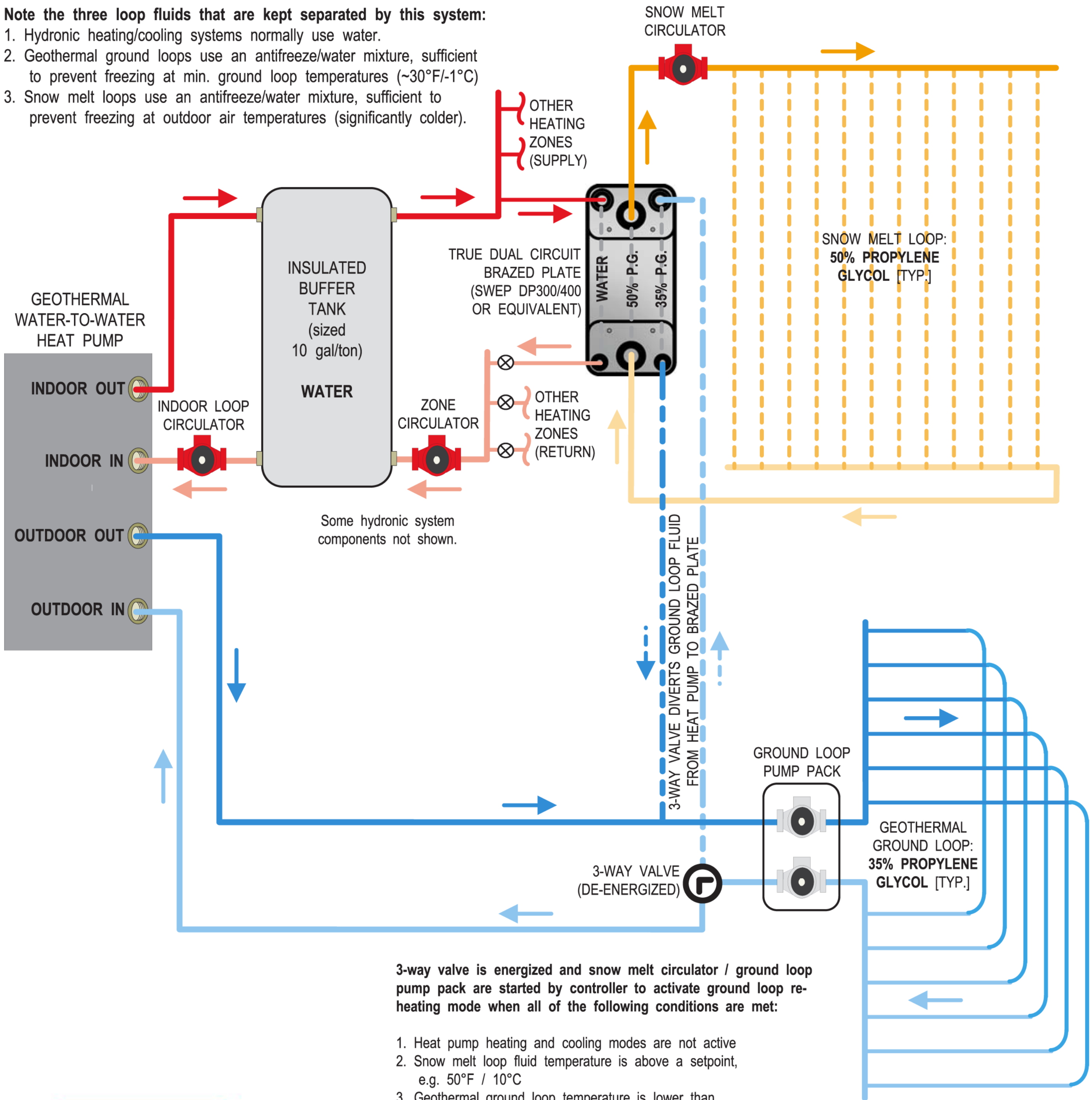
go to TABLE OF CONTENTS

Geothermal Snow Melt System with Warm-Weather Ground Loop Re-heating

The geothermal snow melt system, designed according to ASHRAE guidelines, will efficiently **melt snow and ice** in the winter, and will act as a **solar collector** during warn weather to re-heat the geothermal ground loop and increase its cold-weather performance.

Note the three loop fluids that are kept separated by this system:

1. Hydronic heating/cooling systems normally use water.
2. Geothermal ground loops use an antifreeze/water mixture, sufficient to prevent freezing at min. ground loop temperatures (~30°F/-1°C)
3. Snow melt loops use an antifreeze/water mixture, sufficient to prevent freezing at outdoor air temperatures (significantly colder).



3-way valve is energized and snow melt circulator / ground loop pump pack are started by controller to activate ground loop re-heating mode when all of the following conditions are met:

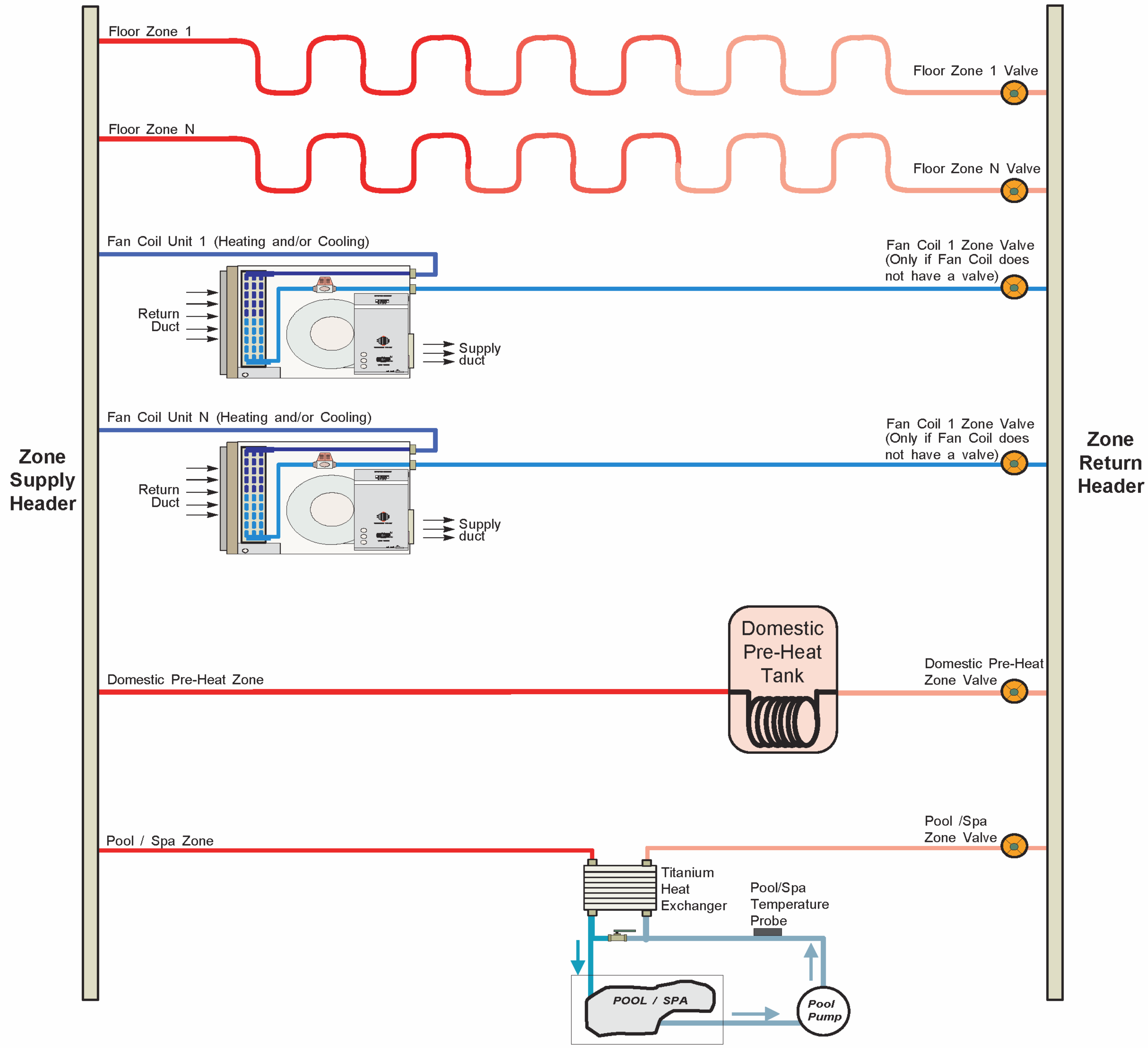
1. Heat pump heating and cooling modes are not active
2. Snow melt loop fluid temperature is above a setpoint, e.g. 50°F / 10°C
3. Geothermal ground loop temperature is lower than snow melt loop temperature by e.g. 10°F / 5°C

When 3-way valve is energized, snow melt hydronic heating zone is locked out.

					Drawn By Dan Rheault	Date 31-Jan-2018	MARITIME GEOTHERMAL LTD. www.nordicghp.com	
					Checked By Dan Rheault	Date 31-Jan-2018	Drawing Name: Piping for Snow Melt with Ground Loop Re-heating	
					Approved By (ENG) Dan Rheault	Date 31-Jan-2018		
01	Initial Release	D. RHEAULT	D. RHEAULT	31-Jan-2018	Approved By (MFG)	Date	Size: A	Drawing Number: 002286PDG · REV: 01 · SHEET: 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By	Date		

go to TABLE OF CONTENTS

Typical Zone Types for Hydronic Applications



NOTES:
1. Floor zones are heating only. Cooling a floor zone will cause condensation in the floor. Floor zone valves should be wired through a relay that is controlled by the cooling signal (O) that breaks the signal when in cooling mode to ensure that they cannot accidentally be energized.
2. There may be multiple floor zones.
3. There may be multiple fan coil units, (heating and /or cooling). A zone valve is not required if the unit has a internal valve.
4. Domestic Pre-Heat Tank is for on-demand apllications. The tank must have a heat eaxchanger in it or an external one must be used to separate the zone loop from the potable water supply.
5. Ensure the floor circulator is adequately sized to accomodate the type and number of zones connected to the system.
6. The pool aquastat will operate the Pool/Spa Zone Valve.

REV	ECO #	IMPL BY	APVD BY	DATE
01	Initial Release	C. GEDDES	C. GEDDES	06 SEP 07

Drawn By	Chris Geddes	Date 06 SEP 07
Checked By	Chris Geddes	Date 06 SEP 07
Approved By (ENG)	Chris Geddes	Date 06 SEP 07
Approved By (MFG)		Date
Approved By		Date

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical Zone Types for Hydronic Applications

Size	Drawing Number	REV	SHEET
A	000530PDG	01	1 of 1

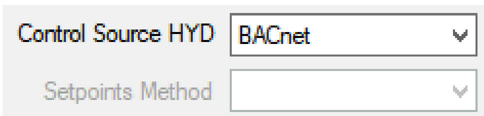
go to TABLE OF CONTENTS

Operation

1. BACnet Control

If using **BACnet Control**, the heat pump will turn the compressors on and off and activate cooling mode (for HAC models) when it is told to by the building control system. This is the most commonly used control method for multiple-unit installations, since it allows lead/lag stage rotation and centralized control of circulation pumps and valves. The heat pump's internal control logic will not be used, except to ***limit loop temperatures*** and report operating data and alarms. See the **BACnet Interface** chapter later in this manual for network specification and BACnet object names.

PC APP: Tools-->Configuration



LCD Interface: Configuration

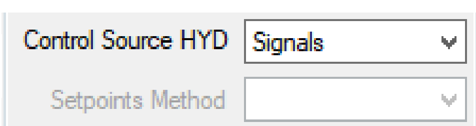
2. Signals / Hardwired Control

Similar to BACnet control, with **Signals Control** the heat pump will turn the compressors on and off and activate cooling mode when it is told to by 24VAC signals. These are provided via external dry contacts from 2-stage aquastat(s) or a non-BACnet controller. See **Wiring** chapter. The heat pump's internal control logic will not be used, except to ***limit loop temperatures*** and activate alarms outputs.

Most single-unit installations will instead use **Setpoint Control**; however, **Signals Control** provides control flexibility for certain situations, for example if two water loops with different setpoints are being heated. Temperature settings similar to those outlined in the following **Setpoint Control** section should be used.

When using Signals Control, the backup tank element thermostat can be set to a safe maximum, allowing the electric elements to be controlled by an external contactor placed in the power supply connections (see diagrams in **Wiring** chapter). The contactor can be controlled by stage 2 of the heating aquastat through a 2-hour timer. Alternatively, tanks with their own programmable controller can be set to run independently with a lower temperature setpoint than the aquastat(s).

PC APP: Tools-->Configuration



LCD Interface: Configuration

3. Setpoint Control

One of the features of the GEN2 Control Board is built in temperature control functionality called "**Setpoint Control**". It is a good method of controlling hydronic heating and cooling demand for a single heat pump or small number of heat pumps since it eliminates the need for an external aquastat or temperature sensor (although external sensors may be used, as described below).

There are four options for Setpoint Control, outlined as follows.

Setpoint Control Method 1 - Indoor Loop (ICR) One Tank

PC APP: Tools-->Configuration

LCD Interface: Configuration

ICR (Internal Circulator Relay) is the default method and uses the **Indoor OUT** temperature probe inside the unit for temperature control. Its value is displayed in the **Tank Temperature** box on the PC App's **View-->Setpoint Control** window, shown below. If this temperature shows **NC**, then either the probe is not connected to the board or there is a problem with it.

The heat pump will cycle the indoor circulator on and off when the unit is idle to sample the water temperature. When heating mode ends, the indoor circulator will continue to run for 30 seconds. It will then cycle with an OFF time and ON time as set by the **Set ICR Sampling** popup which appears when ***SET*** is clicked on the **View-->Setpoint Control** window. The timer counts down the time remaining before the next switch between ON/OFF. The indoor circulator indicator will indicate when the circulator is ON, OFF or SAMPLING. The default sampling times are 2 minutes ON and 6 minutes OFF. The LCD display will also indicate when the ICR is sampling (ON). The ***Timer Override*** button will reduce the countdown timer to 10 seconds. The compressor(s) will only start when sampling is completed.

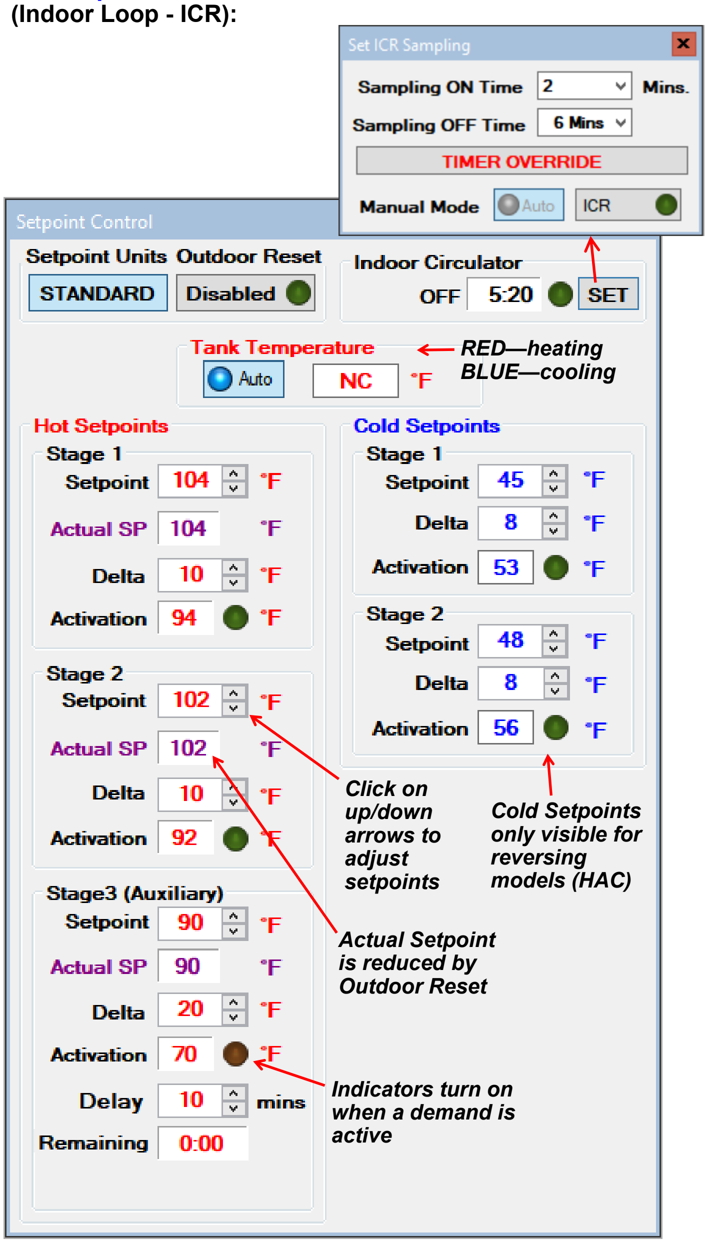
For reversing HAC models only, cooling mode is selected by making a dry contact connection between **R/RA** and **O** on the right side of control board. This is the one external control requirement.

To prevent the compressor from starting when the power is first turned on, stage 1 and stage 2 are **DISABLED** from factory. The LCD display will show "**STAGE1 DISABLED**" and "**STAGE2 DISABLED**" . To enable, use either the ***Stage 1 Enabled/Disabled*** and ***Stage 2 Enabled/Disabled*** buttons at the top right corner of the PC App's ***Tools-->Configuration*** window, or use the LCD interface and select ***SYSTEM EN/DIS***.

See below, and also the **PC Application (PC App)** chapter for full screenshots of the various windows.

go to TABLE OF CONTENTS

The **Setpoint Control** window looks like this for **Method 1 (Indoor Loop - ICR):**



WARNING: When in Manual Override mode, Activation no longer responds to Setpoint Control values (i.e. if a stage is on it will not turn off when the setpoint is reached). Go to the PC App's Control Panel to turn demand ON/OFF with the Stage buttons.

TABLE 13a - Typical W-Series Setpoints

HEATING	Stage 1		Stage 2		Stage 3 (Auxiliary)	
	°F	°C	°F	°C	°F	°C
Setpoint	**108**	***42***	**105**	***41***	**100**	***38***
Delta	**8**	***4***	**8**	***4***	**8**	***4***
Activation *	100	*38*	97	*37*	92	*34*
Delay					**10 minutes**	

COOLING *(HAC only)*	Stage 1		Stage 2		
	°F	°C	°F	°C	*Activation is determined by the Setpoint and Delta values
Setpoint	**45**	*7*	**48**	***9***	
Delta	**8**	*4*	**8**	***4***	
Activation *	53	*11*	56	*13*	

TABLE 13b - Typical WH-Series Setpoints

HEATING	Stage 1		Stage 2		Stage 3 (Auxiliary)	
	°F	°C	°F	°C	°F	°C
Setpoint	**150**	***66***	**147**	***64***	**130**	***54***
Delta	**8**	***4***	**8**	***4***	**20**	***10***
Activation *	142	*62*	139	*60*	110	*44*
Delay					**10 minutes**	

COOLING *(HAC only)*	Stage 1		Stage 2		
	°F	°C	°F	°C	*Activation is determined by the Setpoint and Delta values
Setpoint	**45**	***7***	**48**	***9***	
Delta	**8**	***4***	**8**	***4***	
Activation *	53	*11*	56	*13*	

Heating setpoints will vary widely by application. Lower indoor loop water temperatures may be able to be used, or higher ones may be required. Lower heating setpoints will translate directly into a higher COP (efficiency). Increasing Delta values will also increase efficiency due to longer runtimes, and lead to less wear on compressor due to a reduced number of compressor starts.

The maximum water temperature setpoint for the R410a **W-series** is **130°F / 54°C**, while the minimum setpoint for cooling (HAC units only) is **40°F (4°C)**.

The maximum water temperature setpoint for the R134a **WH-series** is **160°F / 71°C**, while the minimum setpoint for cooling (HAC units only) is **45°F (7°C)**.

Summer Setback

In locations where hydronic cooling is not required, or with non-reversing models, the heating system may be idle for several months in the summer. In this case, the heat pump may be put in **Summer Setback** mode via the PC App's **Tools--> Configuration** window or the LCD Interface.

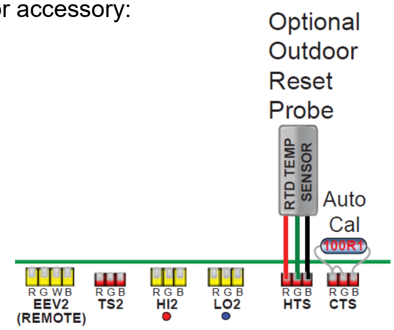
Summer Setback disables stage 3 (AUX), drops setpoints to 70°F (21°C), and decreases temperature sampling frequency to 2 days. This minimizes electric power usage while keeping cast iron head circulation pumps operational.

go to TABLE OF CONTENTS

Outdoor Reset

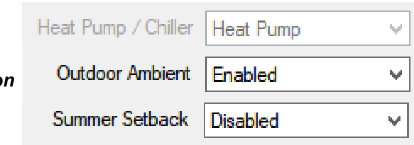
As mentioned earlier, lower heating setpoints will translate directly into a higher COP (efficiency). **Setpoint Control** has an optional Outdoor Reset control algorithm for heating mode, which reduces the heating temperature setpoints at warmer outdoor temperatures as measured by an accessory outdoor temperature sensor.

To enable outdoor reset, first connect the outdoor temperature sensor accessory:



Then enable the outdoor sensor in the **Tools --> Configuration** window or LCD interface:

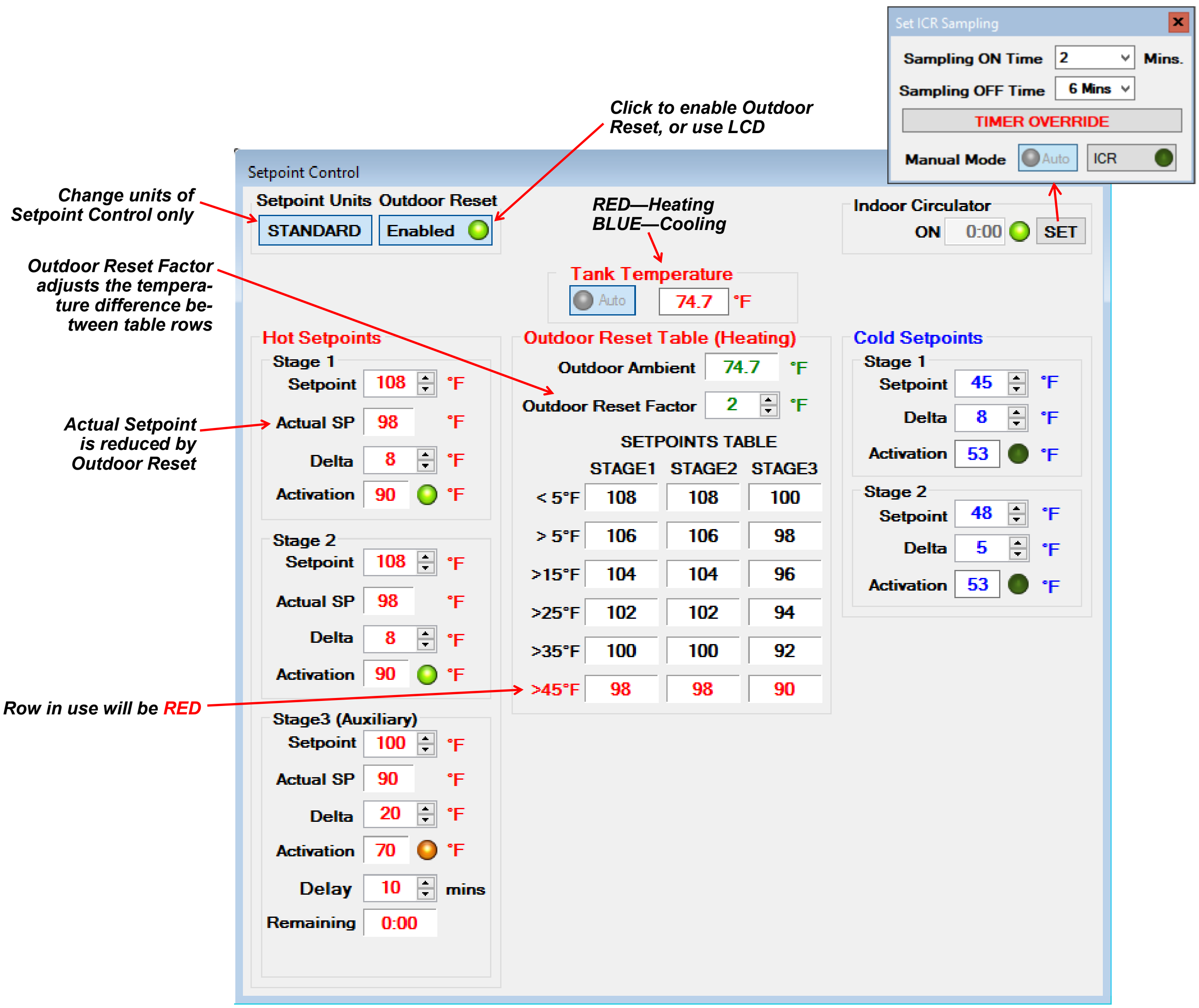
PC APP: Tools-->Configuration



LCD Interface: Configuration

Next, click on the **Outdoor Reset** button at the top of the **Setpoint Control** window. The button will change to say Enabled, the indicator will come on and the Outdoor Reset Table will appear. The table is created by subtracting the value of the Outdoor Reset Factor from the original setpoints once for each table row . The user-selected Hot Setpoints are located in the top row(<5°F), and the next row down equals the row above minus the Outdoor Reset Factor. The table row in use based on current outdoor temperature is shown in red.

It can be seen that as outdoor temperature rises and heating load falls, the heating mode buffer tank temperature will be decreased and a higher seasonal efficiency will result.



go to TABLE OF CONTENTS

Setpoint Control Method 2 - Indoor Loop (ICR) Two Tanks

It is possible to use all of the **Setpoint Control Method 1** settings, and operate two buffer tanks: one for heated water and one for chilled water. The heat pump will switch over to cooling tank in response to a dry contact between the **R/RA** and **O** terminals at the right side of control board. The **O** signal (along with **C/GND**) will also energize a 3-way valve to divert flow to the cold tank (see **Piping** chapter).

However, it is suggested to use **Method 4** (External HTS/CTS with two tanks) for this purpose. This will require two external tank temperature sensors, but has the benefit of both tank temperatures being constantly monitored and also has the added **Auto Maintain** option (maintaining both hot and cold tank setpoints without the requirement for an external "**O**" dry contact).

go to TABLE OF CONTENTS

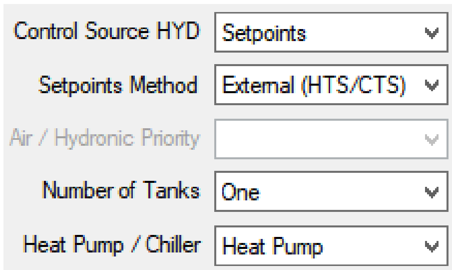
Setpoint Control Method 3 - External (HTS/CTS) One Tank

a) HTS/CTS w/ One Tank - Heat Pump Mode

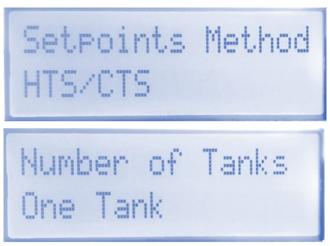
Most of the time, hydronic heating/cooling heat pumps work in response to the temperature of the indoor loop (indoor buffer tank). The previously described control methods (1, 2) work this way, as does this one. This is ***Heat Pump Mode***, and is the only control option for reversing models (HAC).

For non-reversing models (H), it is also possible to control demand based on the temperature of the outdoor or cold loop. This is ***Chiller Mode***, described on next page.

PC APP: Tools-->Configuration

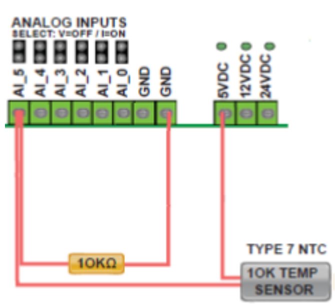


LCD Interface: Configuration



When this method is used, no indoor circulator control for temperature sampling will occur. It requires an external temperature sensor placed in a dry well near the top of the buffer tank. Its value is displayed in the **Tank Temperature** box on the PC App's **View-->Setpoint Control** screen. If this temperature shows **NC**, then either the probe is not connected to the board or there is a problem with it.

A 10K Type 7 (or Type 3) NTC thermistor along with a 10K 1% or better resistor must be connected to the control board in order to use the External HTS/CTS method. These are available as accessories. Connect the sensor to the AI_5 input as shown below and on the wiring diagram (SCH) in the **Model Specific Information** chapter. This sensor will be used for both heating and cooling. ***Remove the AI_5 jumper on the control board.***

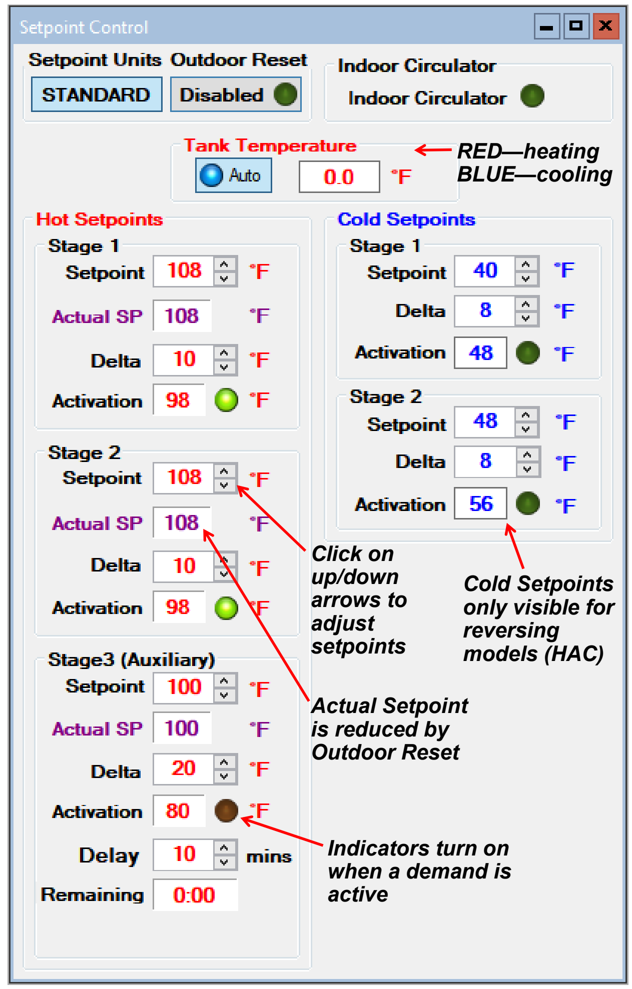


For reversing models only (HAC), cooling mode is selected by making a dry contact connection between **R/RA** and **O** on the right side of control board. This is the one external control requirement.

To prevent the compressor from starting when the power is first turned on, stage 1 and stage 2 are **DISABLED** from factory. The LCD display will show "**STAGE1 DISABLED**" and "**STAGE2 DISABLED**" . To enable, use either the ***Stage 1 Enabled/Disabled*** and ***Stage 2 Enabled/Disabled*** buttons at the top right corner of the PC App's ***Tools-->Configuration*** window, or use the LCD interface and select ***SYSTEM EN/DIS***.

See below, and also the **PC Application (PC App)** chapter for full screenshots of the various windows.

The **Setpoint Control** window looks like this for **Method 3a (External HTS/CTS with One Tank, Heat Pump Mode):**



WARNING: When in Manual Override mode, Activation no longer responds to Setpoint Control values (i.e. if a stage is on it will not turn off when the setpoint is reached). Go to the PC App's Control Panel to turn demand ON/OFF with the Stage buttons.

The features explained in **Setpoint Control Method 1 - Indoor Loop ICR with One Tank** also apply to **Setpoint Control Method 3 - External HTS/CTS with One Tank:**

- **Typical Temperature Setpoints**
- **Summer Setback**
- **Outdoor Reset function**

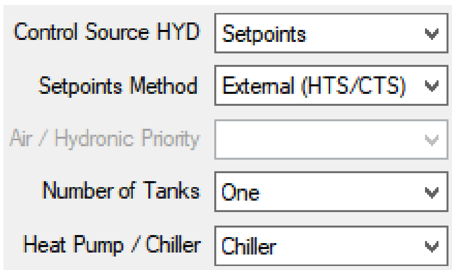
go to TABLE OF CONTENTS

b) HTS/CTS w/ One Tank - Chiller Mode

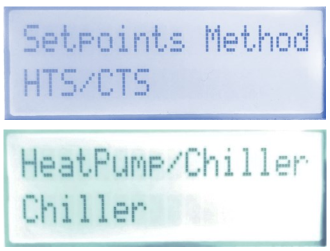
For ***non-reversing models only*** (H), **Chiller Mode** allows the heat pump to be controlled from the Outdoor Loop (cold side) rather than the Indoor Loop (hot side) for applications that require controlled cooling with high temp water rejection. The heat pump is still operating in "heating mode"; it is simply being started and stopped based on the cold side temperature.

Just as with Heat Pump Mode, a buffer tank should normally be used. With **Chiller Mode**, it will be on the cold side (outdoor) loop.

PC APP: Tools-->Configuration

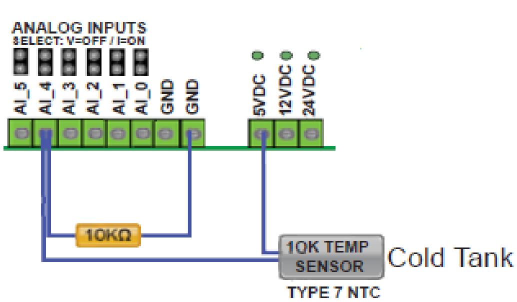


LCD Interface: Configuration



When this method is used, no circulator control for temperature sampling will occur. It requires an external temperature sensor placed in a dry well near the ***bottom*** of the cold buffer tank. Its value is displayed in the **Chilled Tank Temperature** or **Cold Tank** box on the PC App's **View-->Setpoint Control** screen. If this temperature shows **NC**, then either the probe is not connected to the board or there is a problem with it.

A 10K Type 7 (or Type 3) NTC thermistor along with a 10K 1% (or better) resistor must be used. These are available as accessories. Connect the sensor to the AI_4 input as shown below and on the wiring diagram (SCH) in the **Model Specific Information** chapter. This sensor will be used for both heating and cooling. ***Remove the AI_4 jumper on the control board.***



To prevent the compressor from starting when the power is first turned on, stage 1 and stage 2 are **DISABLED** from factory. The LCD display will show "**STAGE1 DISABLED**" and "**STAGE2 DISABLED**" . To enable, use either the ***Stage 1 Enabled/Disabled*** and ***Stage 2 Enabled/Disabled*** buttons at the top right corner of the PC App's ***Tools-->Configuration*** window, or use the LCD interface and select ***SYSTEM EN/DIS***.

See below, and also the **PC Application (PC App)** chapter for full screenshots of the various windows.

The **Setpoint Control** window looks like this for **Method 3b (External HTS/CTS with One Tank, Chiller Mode):**

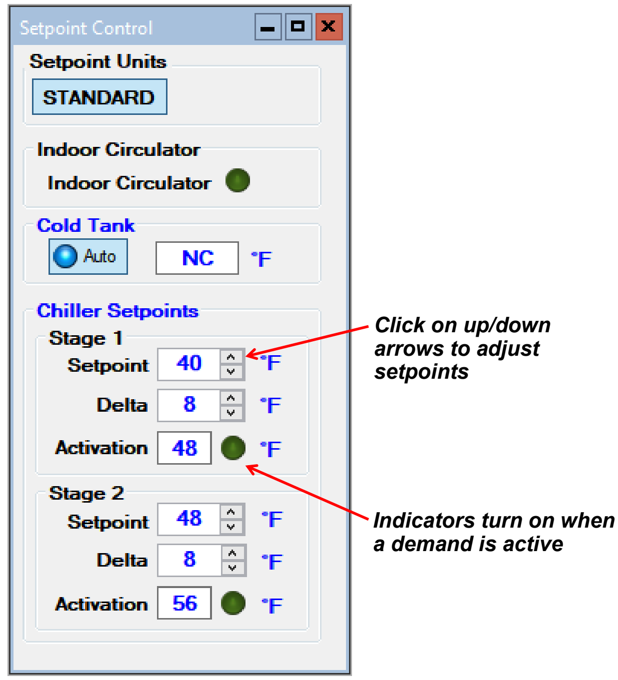
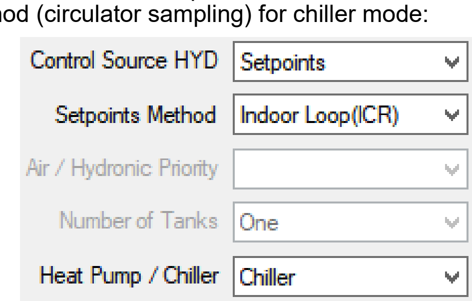


TABLE 14 - Typical Setpoints
HTS/CTS Method-Chiller Mode

	Stage 1		Stage 2		
	°F	°C	°F	°C	*Activation is determined by the Setpoint and Delta values
Setpoint	**45**	***7***	**48**	***9***	
Delta	**8**	***4***	**8**	***4***	
Activation *	53	*11*	56	*13*	

WARNING: When in Manual Override mode the Activation no longer responds to the Setpoint Control values (i.e. if a stage is on it will not turn off when the setpoint is reached). Go to the Control Panel to turn demand ON/OFF with the Stage buttons when in Manual Override Mode.

Above is outlined the recommended method to use Chiller Mode. However, it is also possible to use the ICR setpoint control method (circulator sampling) for chiller mode:



The complication is that sampling will actually be done with the *outdoor* loop circulator, and there is no built in outdoor circulator relay. So two approaches can be taken:

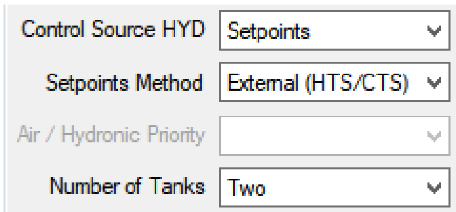
- Connect outdoor circulator to the indoor circulator terminal strip, and vice versa (indoor circulator to outdoor terminal strip) ***OR***
- Install an OCR relay, with coil connected between OV1 (control board DO_0) and C (24vac ground); and outdoor circulator powered from the normally open relay contacts.

go to TABLE OF CONTENTS

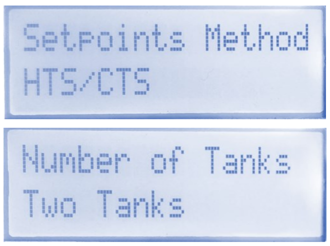
Setpoint Control Method 4 - External (HTS/CTS) Two Tanks

***REVERSING MODELS ONLY (HAC)**

PC APP: Tools-->Configuration

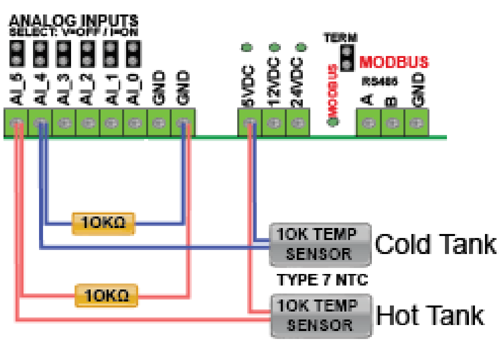


LCD Interface: Configuration

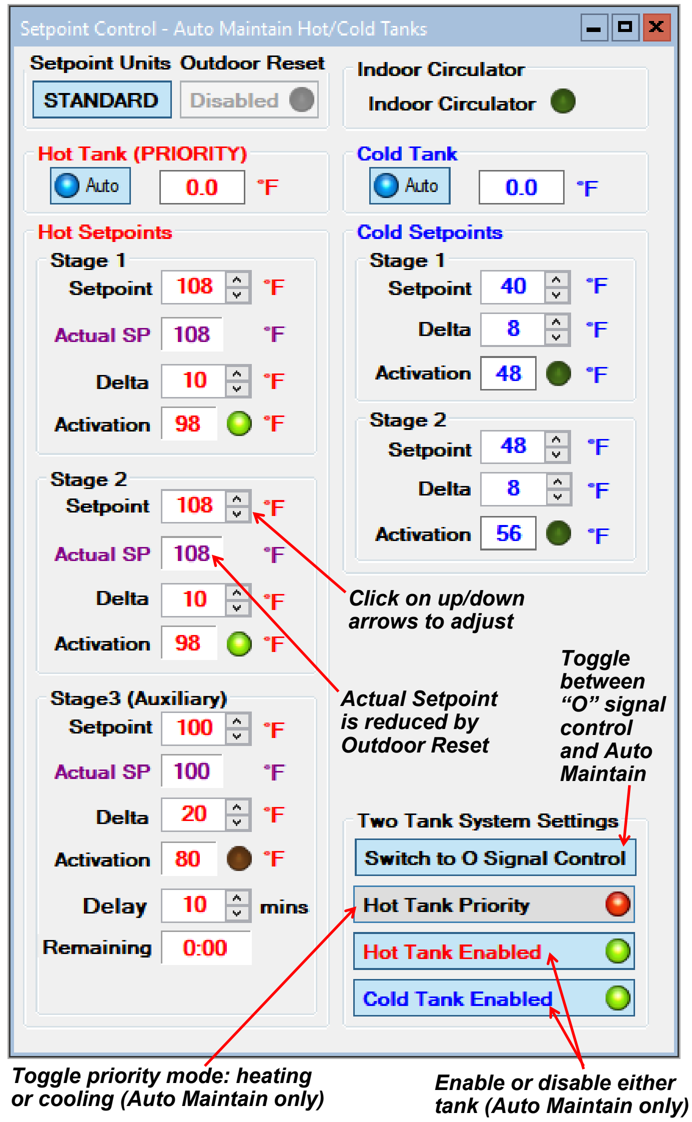


Like with Method 3, when this method is used no indoor circulator control for temperature sampling will occur. It requires an external temperature sensor placed in a dry well in the hot buffer tank as well as one in the cold buffer tank. The values are displayed in the **Hot Tank** and **Cold Tank** boxes in the PC App's **View-->Setpoint Control** window. If either temperature shows **NC**, then either the probe is not connected to the board or there is a problem with it.

10K Type 7 (or Type 3) NTC thermistors along with 10K 1% or better resistors must be connected to the control board. Connect the Hot Tank sensor to the AI_5 input and the Cold Tank sensor to the AI_4 input as shown below and on the wiring diagram (SCH) in the **Model Specific Information** chapter. ***Remove the AI_5 and AI_4 jumpers on the control board.***



The **Setpoint Control** window looks like this for **Method 4 (External HTS/CTS with Two Tanks):**



WARNING: When in Manual Override mode, Activation no longer responds to Setpoint Control values (i.e. if a stage is on it will not turn off when the setpoint is reached). Go to the PC App's Control Panel to turn demand ON/OFF with the Stage buttons.

To prevent the compressor from starting when the power is first turned on, stage 1 and stage 2 are **DISABLED** from factory. The LCD display will show "**STAGE1 DISABLED**" and "**STAGE2 DISABLED**". To enable, use either the ***Stage 1 Enabled/Disabled*** and ***Stage 2 Enabled/Disabled*** buttons at the top right corner of the PC App's ***Tools-->Configuration*** window, or use the LCD interface and select ***SYSTEM EN/DIS***.

See above & below, and also the **PC Application (PC App)** chapter for full screenshots of the various windows.

The features explained in **Setpoint Control Method 1 - Indoor Loop ICR with One Tank** also apply to **Setpoint Control Method 4 - External HTS/CTS with Two Tanks:**

- **Typical Temperature Setpoints**
- **Summer Setback**
- **Outdoor Reset function**

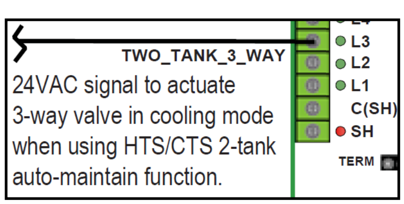
a) O Signal Control

Cooling mode may selected by making a dry contact connection between **R/RA** and **O** at the right side of control board. This results in one external control requirement. **O** and **C** can be used to energize a 3-way valve to divert flow to the cold tank (see **Piping** chapter).

b) Auto Maintain

Alternatively, the heat pump can automatically switch between heating the hot tank and chilling the cold tank, without the need for any external control signals. Click the "**Switch to Auto Maintain**" button in following screenshot (PC App only). If using this function, hot tank or cold tank can be set as priority, and either tank can be disabled to turn it off.

For Auto Maintain, the **L3** signal from the left side of control board in conjunction with **C/GND** should be used to energize the 3-way valve in cooling, since there is no **O** signal.

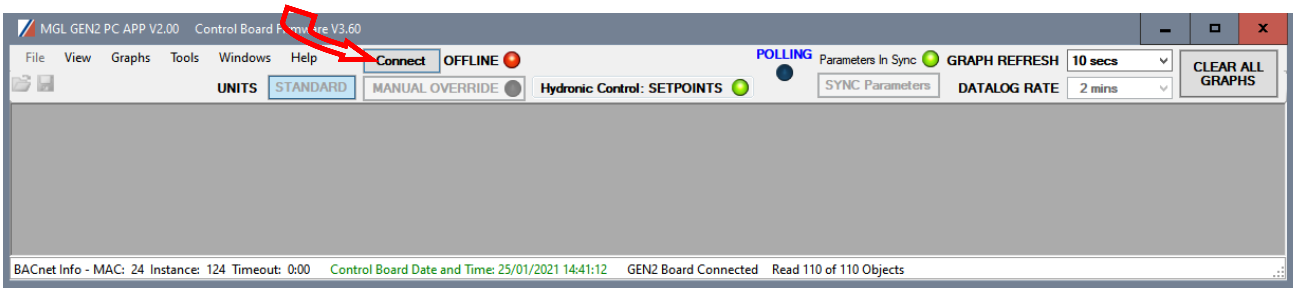


go to TABLE OF CONTENTS

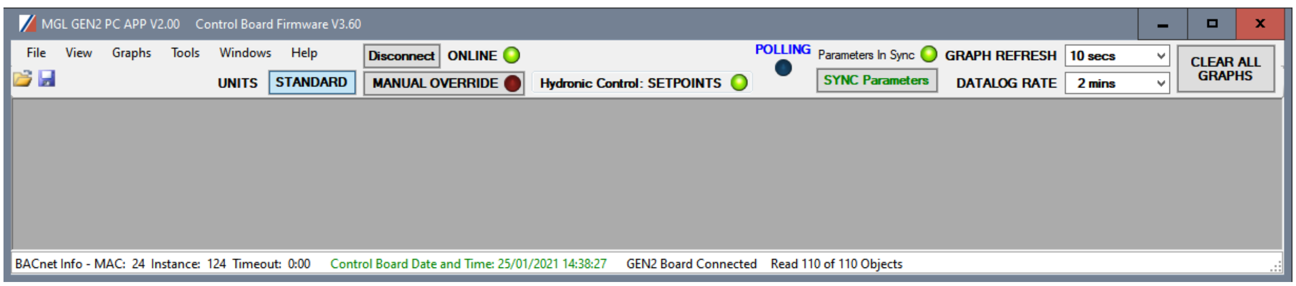
PC Application (PC APP)

NOTE: Before using the PC Application, refer to **Appendices** for installation instructions for the PC Application and USB driver for the COM port. Both must be installed in order to run the PC App and communicate with the control board.

Connect a USB cable between the PC and the control board USB connector located at the bottom center of the board. Use the Windows Start menu to launch the PC App. You should see a screen similar to the one below. The revision of the PC APP is shown in the top left corner of the screen. Click the ***Connect*** button to begin communications with the control board.



Once connected, the menus and buttons will become accessible, the number of Objects available and Read should appear (they should be the same) and the Polling LED will begin to flash. The PC time and date will appear at the bottom left corner of the screen. Clicking on "Control Board Date and Time" will display the current control board date and time. If the date and time need to be adjusted, click on menu ***Tools—>Set Date and Time***. The control board date and time will be set to that of the PC.



PC Application Menus

The following pages describe the PC APP's menus in detail. There are six menus: ***File, View, Graphs, Tools, Windows, Help***.

File Menu: This menu handles page arrangements. If one or multiple pages are open and arranged as desired for viewing, this page arrangement may be saved and re-used the next time the PC APP is used.

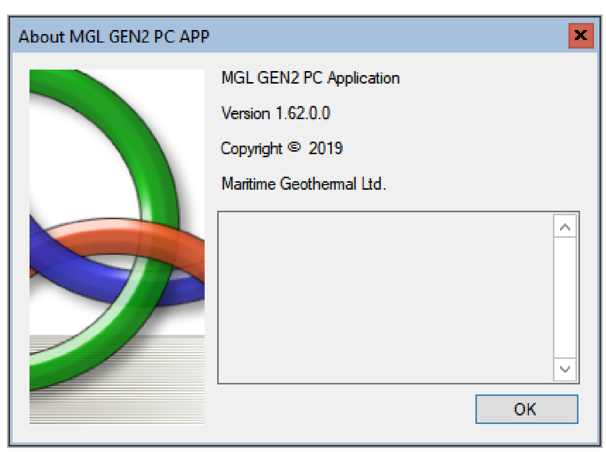
File-->Open: Opens a saved page arrangement.
File-->Save: Saves the current page arrangement under the current name.
File-->Exit: Exits the PC Application.

Windows Menu: This menu is used to arrange windows (pages), or to bring a particular window to the front.

Windows-->Cascade: Arranges windows one in front of the other each with a small right and down offset from the last.
Windows-->Tile Vertical: Arranges windows side by side, stretching them fully from top to bottom.
Windows-->Tile Horizontal: Arranges windows up and down, stretching them fully from left to right
Windows-->Close All: Closes all open windows.

Help Menu: This shows information about the PC Application.

Help-->About: Displays the window shown to the right.

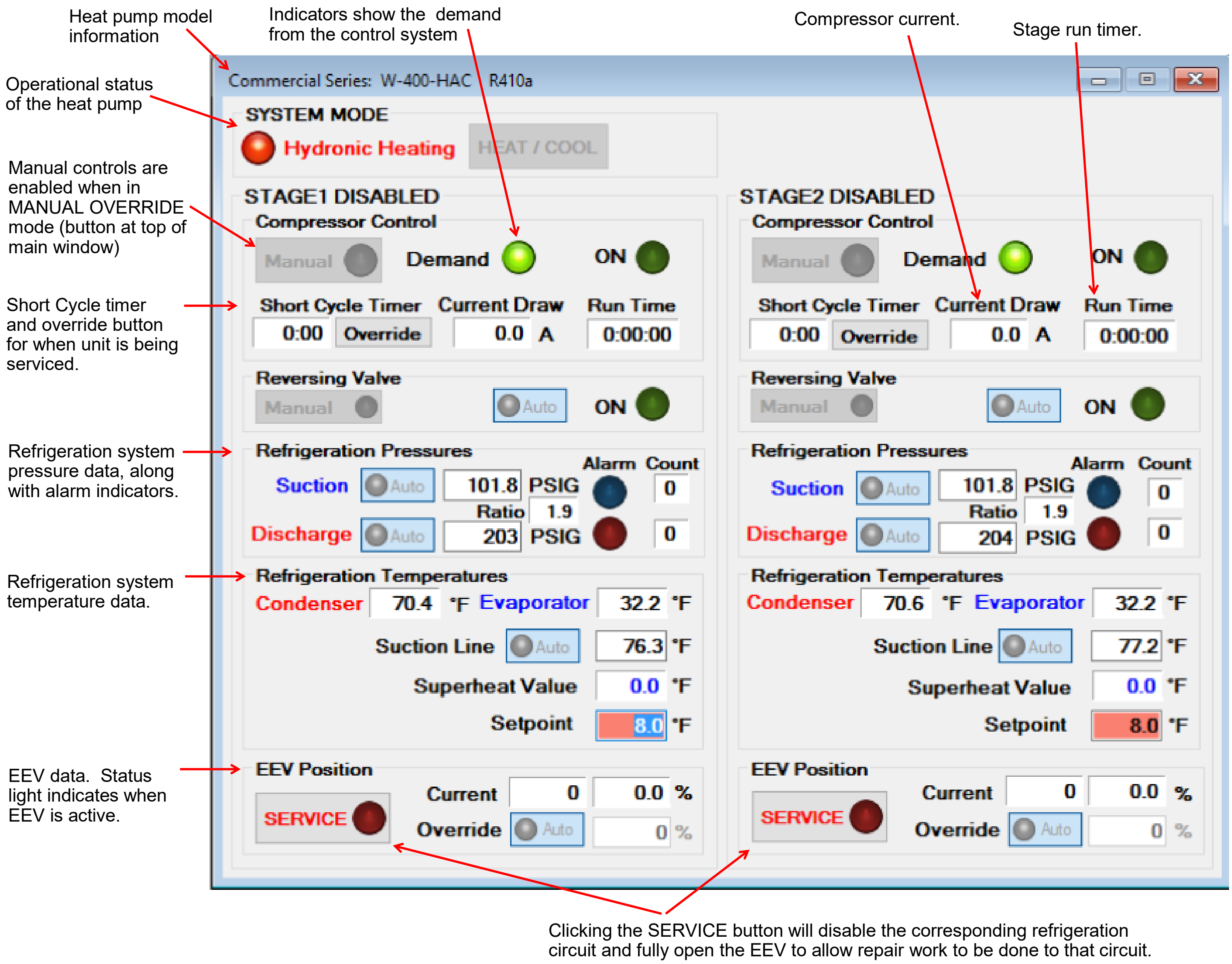


go to TABLE OF CONTENTS

View Menu:

This menu handles all of the operational viewing screens. Clicking on the View submenus will open the page in the PC APP's frame. The next few pages of the manual show screenshots of each of the pages along with some descriptions of what is on each page.

View-->Control Panel: The main control panel window will open, shown below.

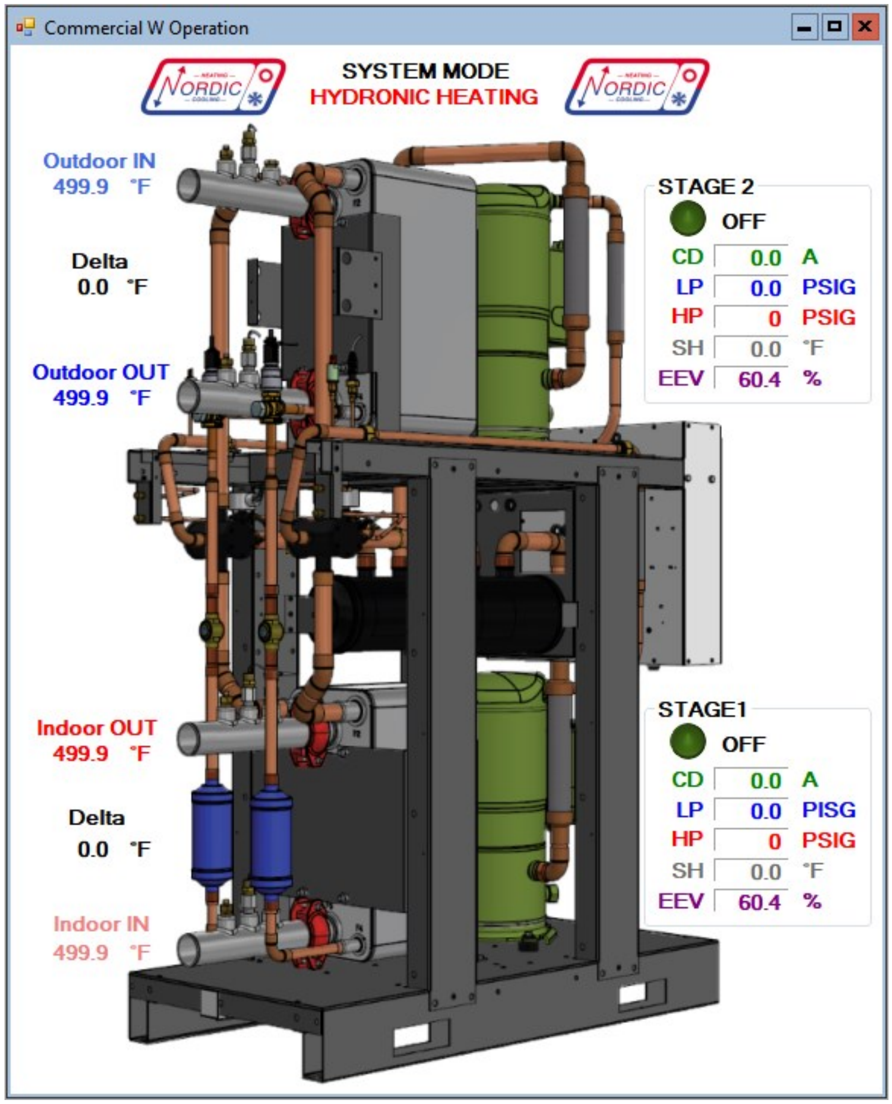


go to TABLE OF CONTENTS

View-->Commercial W Operation:

Shows a graphical display that allows convenient monitoring of heat pump operation, including:

- operation mode, and stage 1 & 2 on/off status
- water line in/out temperatures and delta T
- compressor current draw
- low & high refrigeration pressures
- superheat and EEV % open



View-->Setpoint Control:

Shows the on-board temperature control screen. This screen is only available when **Control Source HYD** on the Configuration Page is set to **Setpoints** (not **BACnet** or **Signals**).

Refer to the **Operation** chapter earlier in this manual for details.

View-->Alarms, Limits and Faults

The alarms page has four tabs:

1. **ALARMS** - Current alarm status, alarm count, high and low refrigeration alarm cutout values, and short cycle timer.
2. **ALARMS LIST** - List of alarms that have occurred since the PC APP has been operating (this will be lost when the PC is disconnected from the control board.)
3. **LIMITS** - Limits in effect which prevent compressor operation but that do not cause an alarm.
4. **FAULTS** - List of board hardware faults.

go to TABLE OF CONTENTS

View-->Alarms, Limits and Faults (ALARMS Tab):

NOTE: Greyed out Alarms in the PC APP are not applicable to the system setup and are not monitored by the control board.
NOTE: Refer to Alarms and Faults screenshot below to see which alarms have a count.

Alarms without a count only occur one time at which point they immediately create a **Permanent Alarm**.

Alarms with a count: when an alarm occurs the compressor will stop, the alarm count will increase, and the ***Short Cycle Timer*** will start. When the ***SC Timer*** expires the compressor will re-start. If no further alarms occur within ***Count Reduce Time***, the alarm count will be reduced by 1. If another alarm occurs within ***Count Reduce Time*** (see Configuration window) the count will increase by 1. If alarms continue to occur, when the alarm count reaches the ***Maximum Count*** value a ***Permanent Alarm*** will occur. The compressor will be locked out until the ***Permanent Alarm*** is manually reset either by cycling the power or clicking on the ***RESET*** button.

Master Alarm is active when any permanent alarm is active. It is used to simply indicate that there is an alarm.

Low Pressure: The suction pressure has dropped to or below the ***Low Pressure Cutout*** value. When the compressor starts, a low pressure condition will be ignored for the number of seconds that ***Low Pressure Ignore on Start*** *(menu **Tools-->Configuration, Alarms and Delays** tab)* is set to, after which the low pressure alarm will be re-enabled. This allows a dip in suction pressure below the cutout point during startup without causing a nuisance alarm.

High Pressure: The discharge pressure has risen to or above the ***High Pressure Cutout*** value.

Compressor Monitor: The compressor protection module (if present) has sent a fault signal to the control board, generally due to the compressor windings overheating.

Compressor Status: There is a current draw as sensed by current sensor but no call for the compressor to be on (i.e. stuck contactor) or there is a call for the compressor to be on but there is no current draw (i.e. manual high pressure control is open or contactor failure).

Phase Monitor: The phase monitor has detected a fault condition and sent a fault signal to the control board. For three phase units only.

Comp. Not Pumping: Discharge pressure is less than 30 psi higher than suction pressure after 1 minute run time. It indicates leaking reversing valve, manual high pressure control trip, bad contactor, or defective compressor.

Low Charge / EEV: The EEV has been at >99% for 20 minutes within first hour of a cycle.

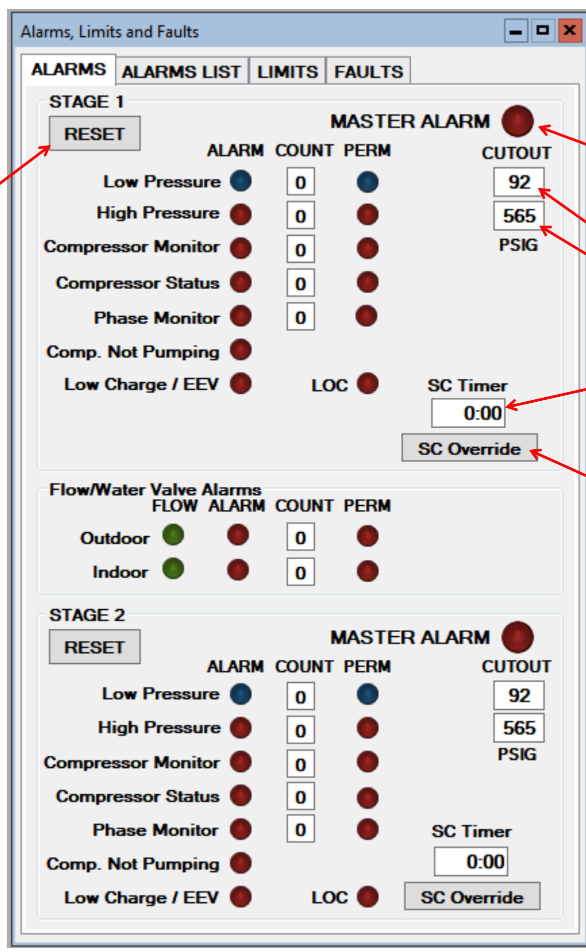
LOC (Loss of Charge): This alarm occurs if the low pressure and/or high pressure sensors read below 30 psig (207kPa).

Flow: Outdoor or indoor loop flow switch did not detect flow. Non-reversing units do not have indoor flow switch.

Go the Alarms Troubleshooting section of the Troubleshooting chapter of the manual to address alarm issues.

This button will erase all alarms and alarm counters, including a permanent alarm.

WARNING: Repeated resets can freeze and rupture heat exchangers, ruining the heat pump and voiding the warranty. The source of the alarm should be determined before resetting the unit if possible or during operation after a reset.



Master Alarm occurs when any alarm occurs.

Low Pressure cut out
High Pressure cut out

Short Cycle Timer counts down time until the next compressor start is allowed.

This button will reduce the short cycle timer value to 10 seconds.

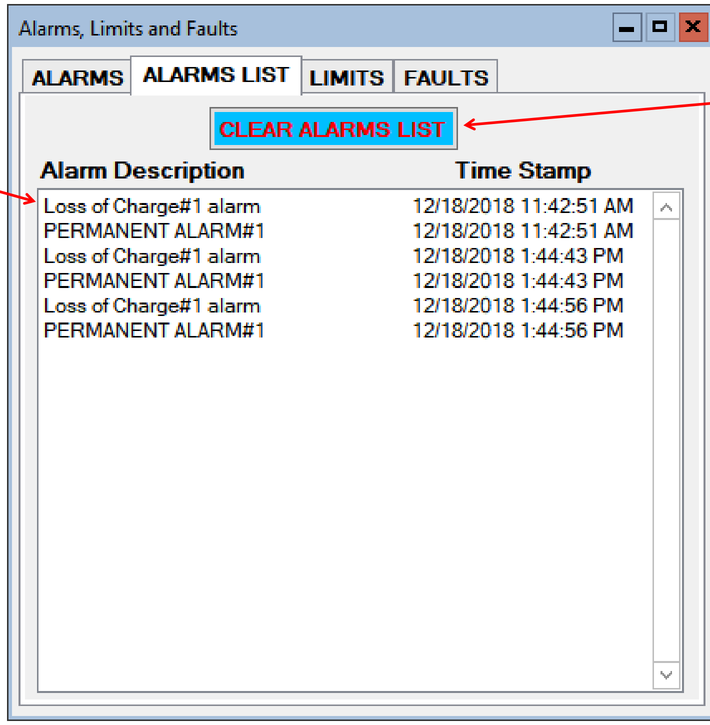
Greyed out alarms (if any) are not applicable to the system.

go to TABLE OF CONTENTS

View-->Alarms, Limits and Faults (ALARMS LIST Tab):

This tab show a history of alarms that have occurred since the PC APP was connected to the control board. This list will be lost when the PC APP is disconnected.

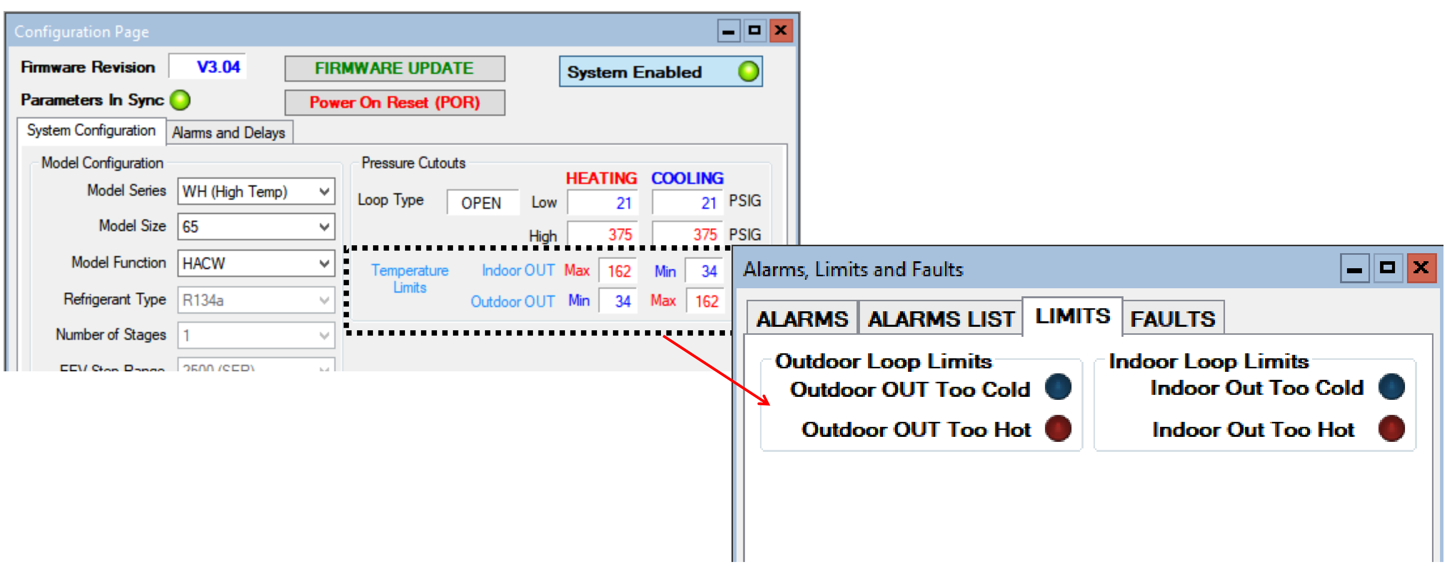
Each alarm that occurs while the PC APP is connected to the control board will appear here. The alarm type and a time stamp will be shown. The alarms list will be erased when the PC APP is disconnected from the control board.



This button will erase the alarm events in the Alarm List.

View-->Alarms, Limits and Faults (LIMITS Tab):

This tab shows temperatures that are out of limits but have not caused an alarm. These limits are shown on the **Tools-->Configuration** page.



go to TABLE OF CONTENTS

View-->Alarms, Limits and Faults (FAULTS tab):

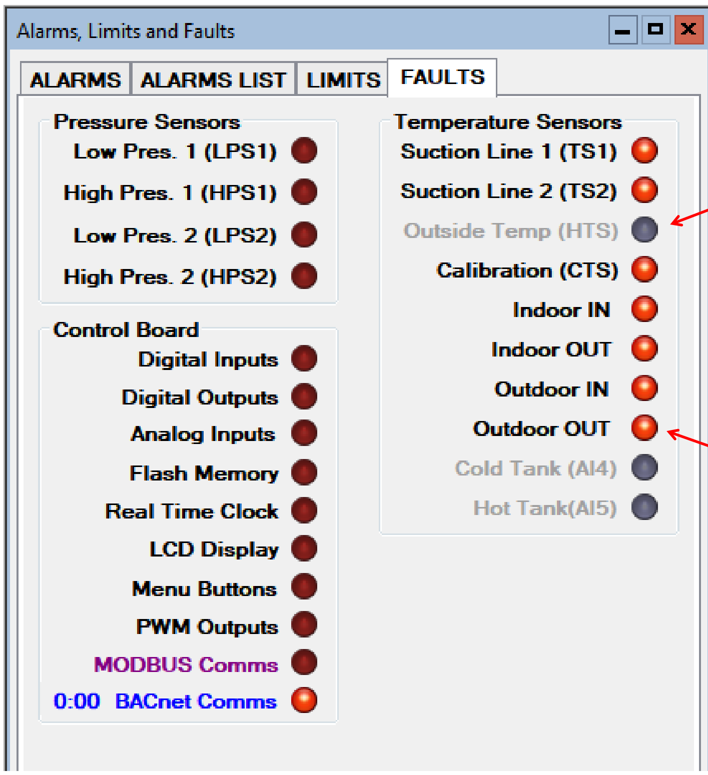
This tab shows hardware faults that could occur. If one of these faults occurs there may be a problem with the control board hardware, with LCD Display and buttons, or with a sensor.

If a fault occurs, some things to try:

- Turn the power to the heat pump off for 20 seconds and then back on again.
- Use the menu item ***Tools-->Reset to Factory Defaults***. If this clears the fault then the system configuration will have to be set up again.
- For LCD Display or Menu Button faults, turn off the power, disconnect and reconnect the cable between the LCD display board and the control board, then turn the power back on again.

If the fault persists then there is most likely a hardware problem, and the sensor, control board, or LCD display board will need to be replaced.

IMPORTANT NOTE: If the Indoor OUT (I_OUT) temperature sensor is faulty or disconnected, neither the heat pump nor the auxiliary will operate if using Setpoint Control. They will continue to operate under BACnet control.

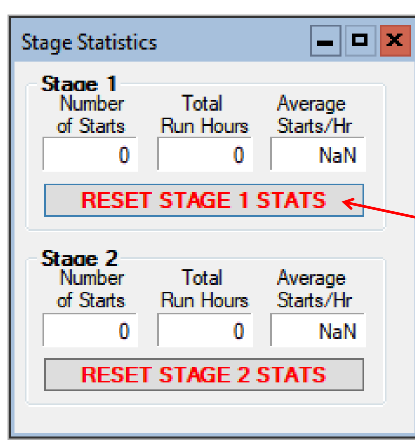


Greyed out do not apply.

Fault Indicators

View-->Stage Stats:

The compressor information: number of starts, run hours and starts per hour.

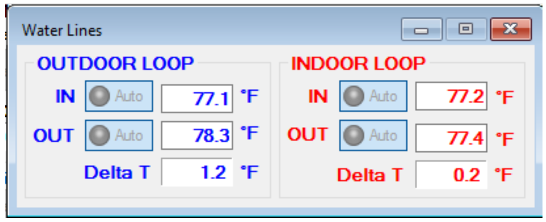


Erase the compressor statistics (only for if a compressor should need to be replaced).

go to TABLE OF CONTENTS

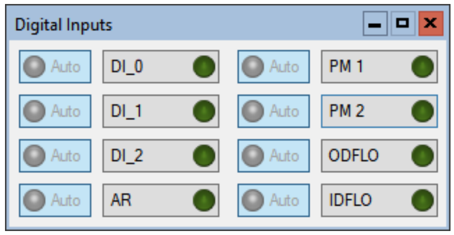
View-->Water Lines

Shows the water line temperatures.



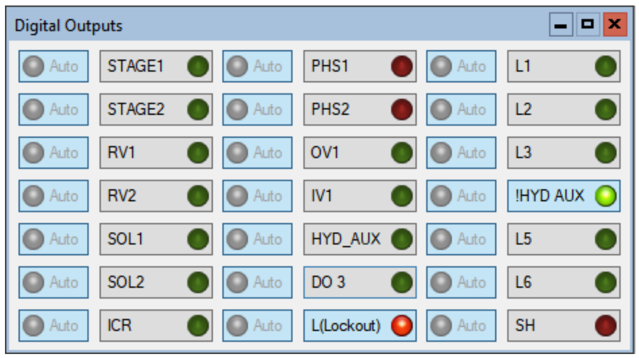
View-->Digital Inputs

Shows the digital inputs and their individual status (ON/OFF). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.



View-->Digital Outputs

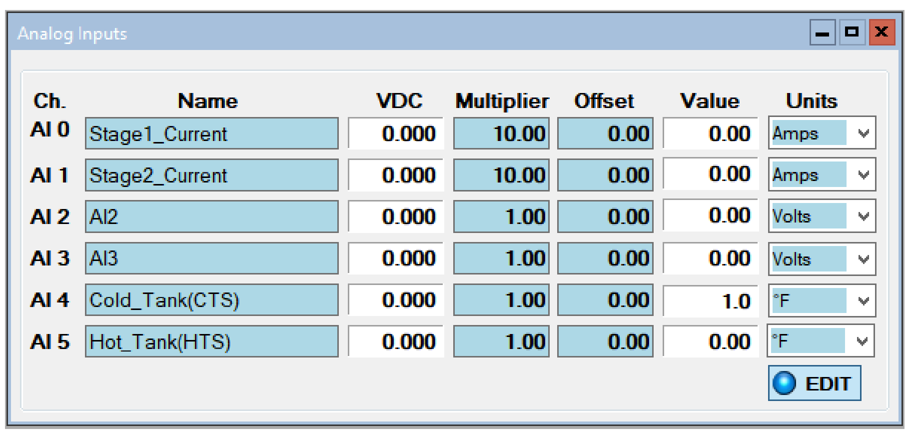
Shows the digital outputs and their individual status (ON/OFF). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.
.



View-->Analog Inputs

Shows the Analog inputs and their individual settings and values.

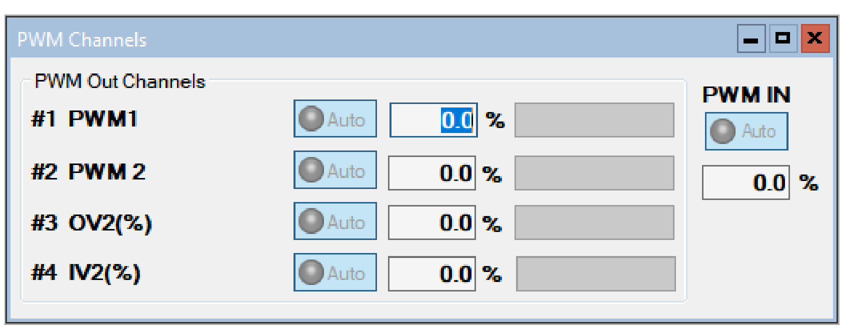
Click on the ***EDIT*** button to modify the blue boxes (button will now say ***SAVE***). For each channel a name may be selected (up to 16 characters), and the multiplier and Offset values may be set to accommodate the connected sensor scaling. Signals may be 4-20mA (channel jumper on board ON) or 0-10VDC (channel jumper on board OFF). A variety of units are also available for selection of common measurement types. Click on ***SAVE*** to save the changes. Values are kept even when power is removed from the unit.



View-->PWM Channels

Shows the PWM channels and their individual status (0-100%). They may be individually controlled when in Manual Override Mode in order to facilitate troubleshooting.

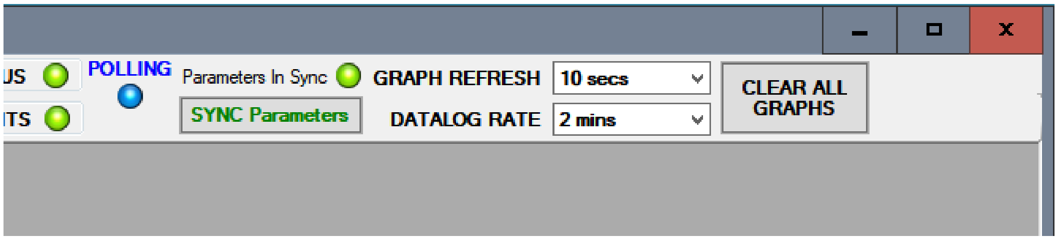
EMW-series does not use any PWM channels.



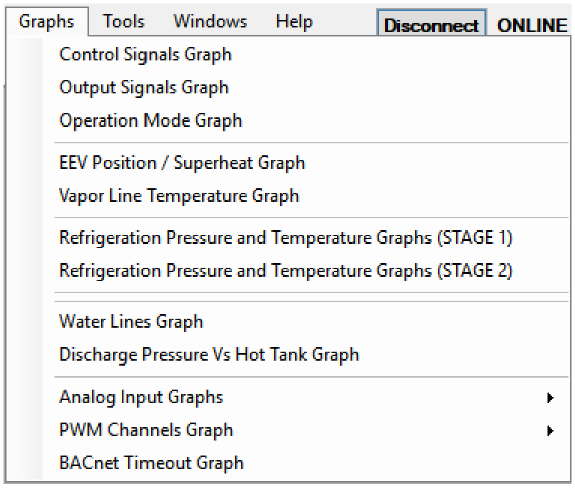
go to TABLE OF CONTENTS

Graphs Menu:

This menu is a list of the available graphs. Graphs are real-time and show a time stamp of when the recording started as well as a current time which will show up if the graph is screen captured. Each graph has a CLEAR button which will erase the stored data and restart the graph. There is also a master CLEAR ALL GRAPHS button at the top right of the PC APP; this will clear all open graphs and re-start them all simultaneously to keep them in sync with each other. The refresh rate for the graphs is also located at the top right of the PC APP.



TIP: To screen print a graph and save it as a picture, press Print Screen on the keyboard and then paste into MS Paint or other graphics program. Select the desired graph with the selection tool and copy it to a new MS Paint, then save the file as the desired name.



ON/OFF status of the system control signals (demands).
ON/OFF status of digital outputs.
ON/OFF status of heating and cooling modes.
EEV position and resulting superheat.
Suction temperature.
Suction and discharge pressures & temperatures for Stage 1.
Suction and discharge pressures & temperatures for Stage 2.
2 tabs: one for Indoor IN/OUT/Delta T, and one for Outdoor IN/OUT/Delta T.
Discharge pressure vs. hot tank temperature.
All analog input channels (0-10VDC or 4-20mA).
All PWM / 0-10VDC output channels and one PWM / 0-10VDC input channel.
For troubleshooting synchronization with 3rd party BACnet controllers.

Below is an example of a typical graph screen. Items that are checked will be plotted, unchecked items will not. The graph screens show the time the graph started as well as the current time to time stamp the graph when screen printed.

Graph Name

CLEAR button erases all graph data.

Check boxes to select which items are graphed

Current values

Primary Y axis on the left, secondary Y axis on the right.

X axis = Number of samples.

Elapsed time =
Number of Samples **x** Refresh Rate.

e.g. 20 samples **x** 1 second refresh =
elapsed time of 20 seconds.

go to TABLE OF CONTENTS

Tools Menu:

This is where various tools for system setup and monitoring are located.

Tools-->Configuration (System Configuration tab):

This is where the system setup is done. ***Settings should only be changed by a person who has a good understanding of system operation***. Improper settings could cause the system to operate poorly or not at all.

Green when parameters have been updated, red during the update

Firmware revision can also be seen on the LCD during power up

Firmware update: see Appendix

POR: reset control system as would be done by cycling power

Enable/disable compressor 1 and 2. Units are shipped as Disabled to prevent an unintentional compressor startup.

Model Configuration chapter to select the system type

Select model series, size, & function (refer to unit nameplate; **will be set from factory**)

R410a for W-series *or* **R134a** for WH-series.

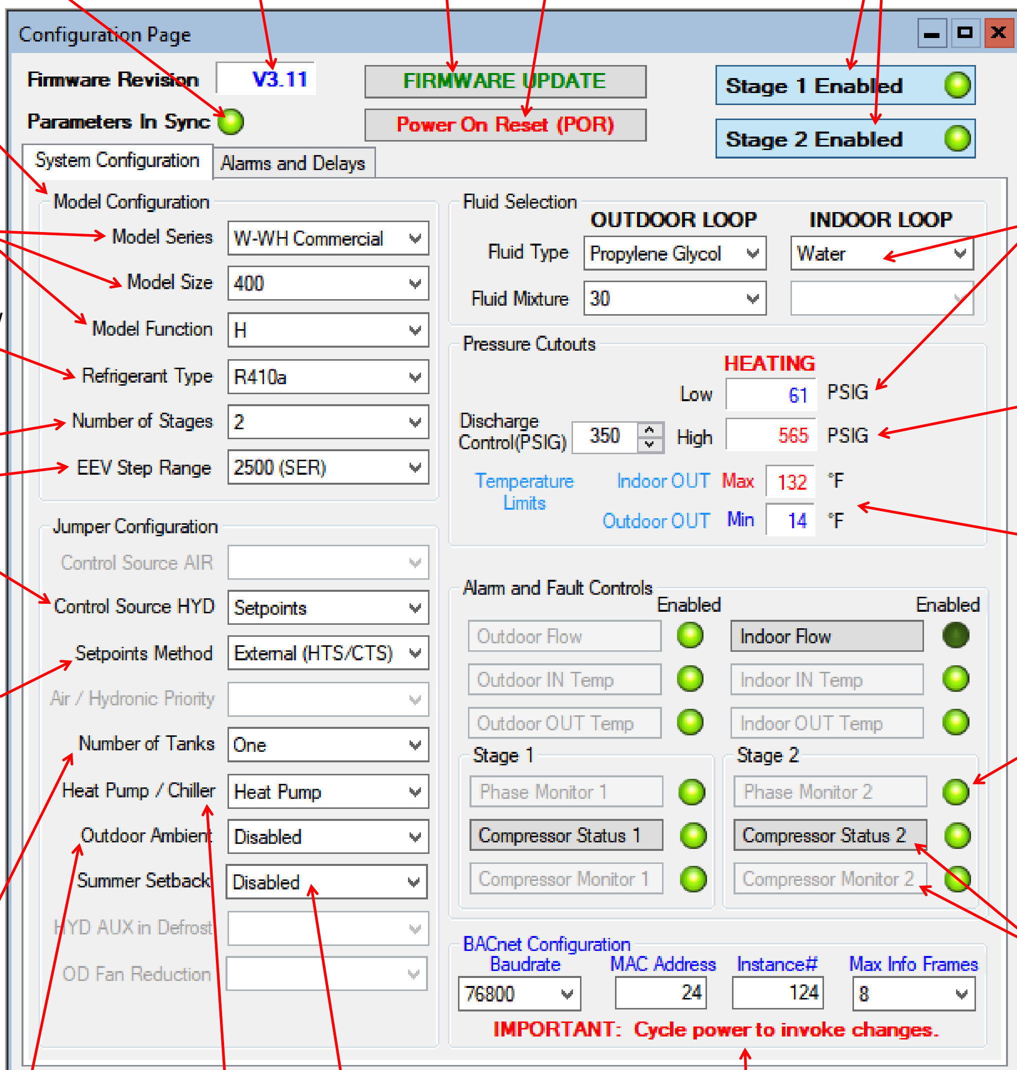
Most commercial units are 2-stage

Always 2500

Selects how the heating/cooling demand will be controlled: BACnet, Setpoints, or Signals.

Selects whether to use the internal temp sensor (Indoor Loop/ICR) or external sensor (External HTS/CTS). **For Setpoint Control only.**

Selects whether there are one or two tanks (hot and cold) in the system. Default value is One. **This is for Setpoint Control operation with HTS/CTS method only.**



Fluid selection determines the low pressure cutout values. Select the appropriate Fluid Type and Fluid Mixture **by volume**.

High pressure cutout is determined by refrigerant type.

Temperature limits determined by series, function, and loop type

The Enabled indicators show which alarms are active

If an alarm is mandatory or not available, the Enable button will be greyed out. For optional alarms (requiring Phase Monitor or Current Sensor accessories) the Enable button will be available; click to enable.

When Summer Setback is enabled: disables stage 3 (AUX), drops setpoints to 70°F (21°C), & decreases temperature sampling frequency to 2 days. Can also be set through LCD.

Outdoor Ambient
Enable if using optional sensor to measure outside temperature which is used in conjunction with the Outdoor Reset functionality of Setpoint Control.

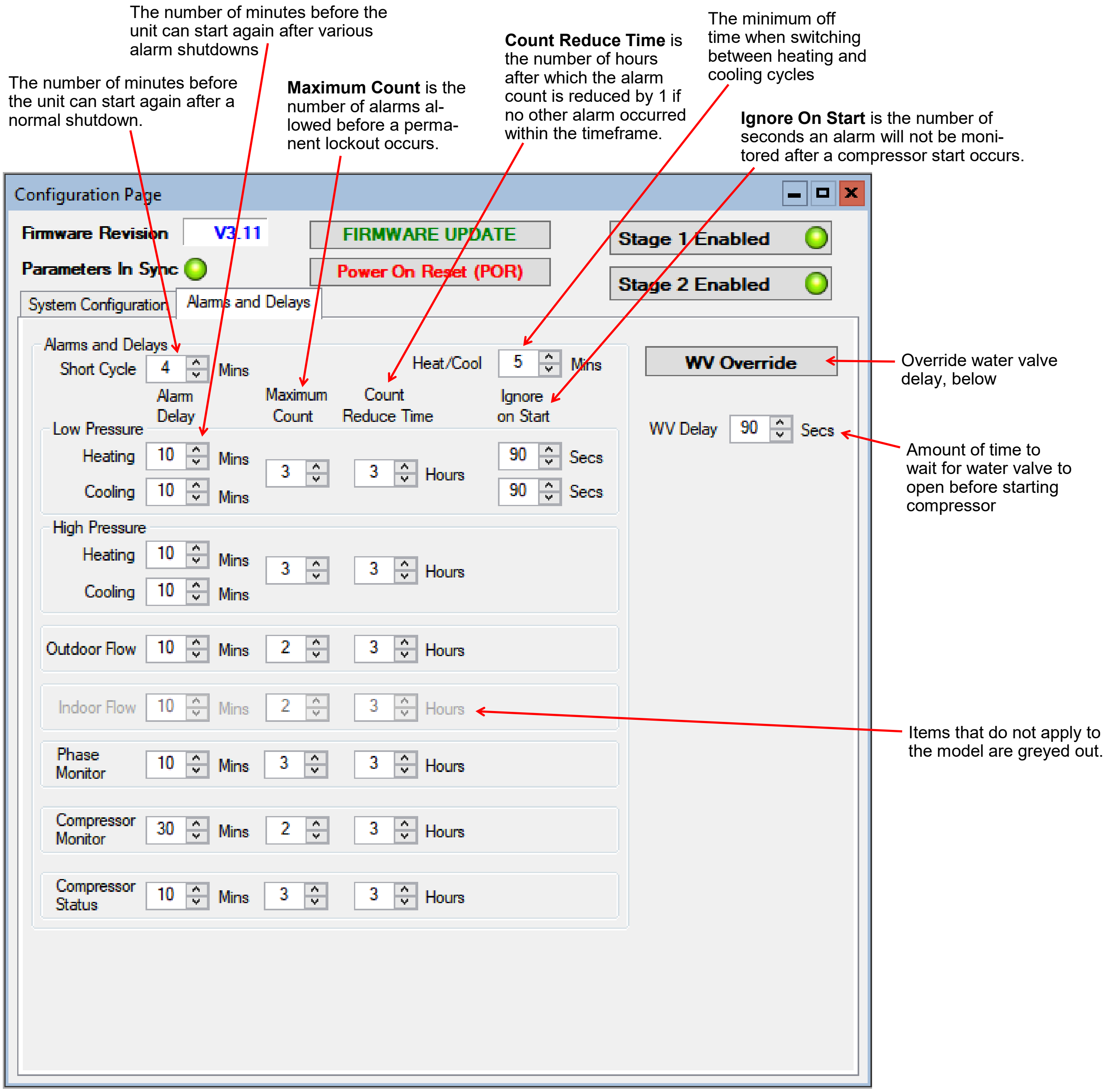
Heat Pump / Chiller
Non-reversing units using Setpoint Control only. Heat Pump is default, controls based on hot tank temperature. Chiller mode control based on chilled water temperature.

If Control Source HYD is set to **BACnet**, set communication parameters. Disconnect PC App and cycle unit power to register changes to BACnet parameters.

go to TABLE OF CONTENTS

Tools-->Configuration (Alarms and Delays tab):

Click on the UP/DOWN arrows to change the value, noting that values have both a low and high limit.



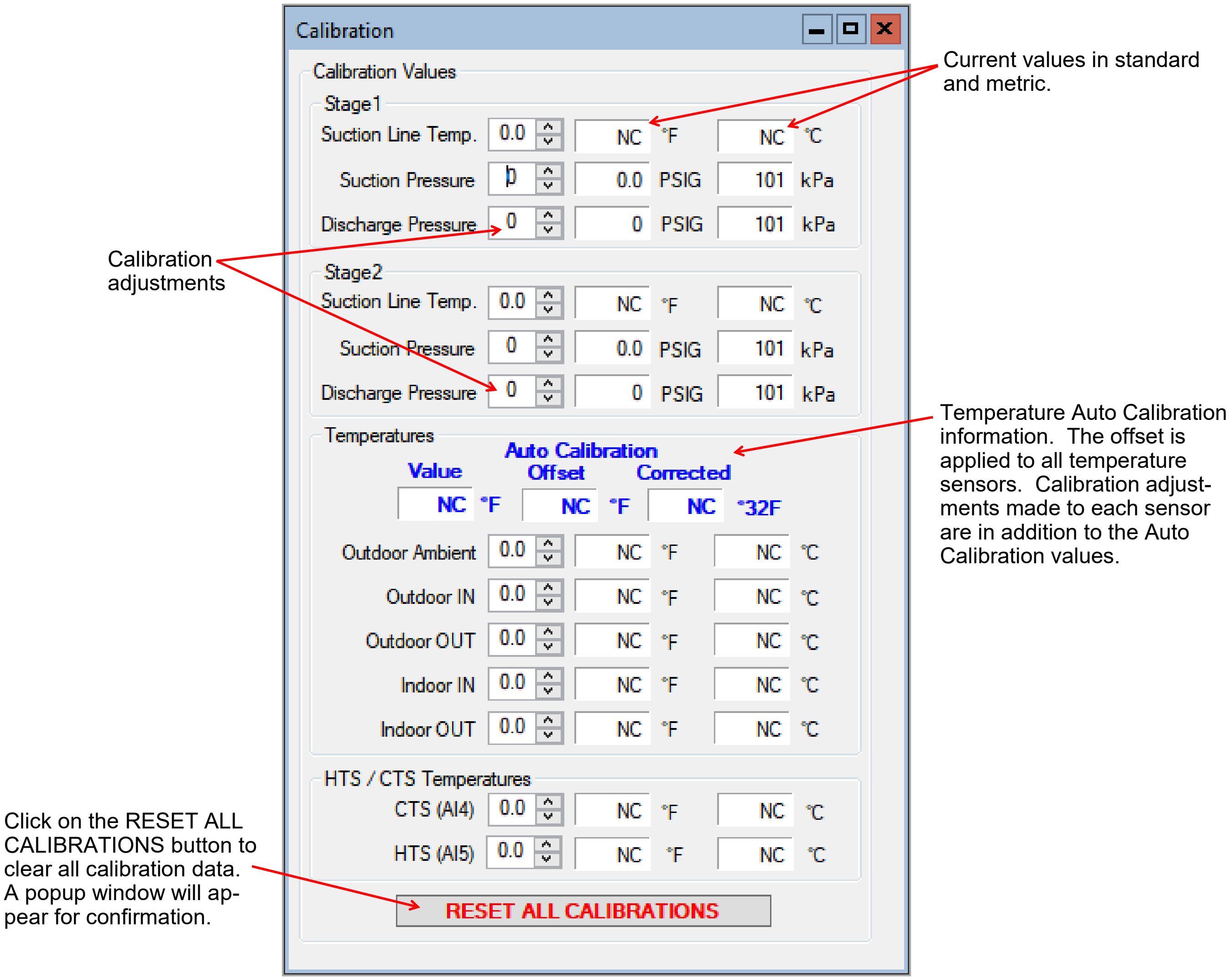
go to TABLE OF CONTENTS

Tools-->Calibration:

Generally there is no need for calibration.

The suction and discharge pressures may be calibrated in increments of 1 psi if there is a discrepancy in the readings when compared to a known good reference.

Temperature sensors may be adjusted in increments of 0.1°F. There is an **AUTO CALIBRATION** routine in the program that continually calibrates the temperatures sensors against an on board reference resistor by applying an offset to the temperature sensors. Calibration adjustments made here are in addition to the Auto Calibration routine.

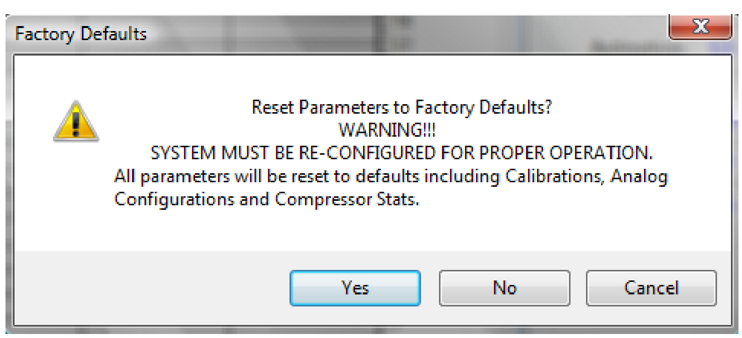


Tools-->Reset to Factory Defaults:

This will reset all parameters to default values.

THE SYSTEM MUST BE RECONFIGURED AFTER A RESET IS PERFORMED.

A reset will default the system to a two stage ATW Series Size 65 with Signals as the control source. Calibrations, alarm delays, analog configurations, compressor statistics, and Setpoint Control values will be returned to defaults as well.



Tools-->Set Date and Time:

This will synchronize the date and time of the control board with the computer's date and time, and will be necessary for new units or units that have been powered off for several days or more.

The date and time of both the computer and the control board are shown in the status bar at the bottom of the PC App.

go to TABLE OF CONTENTS

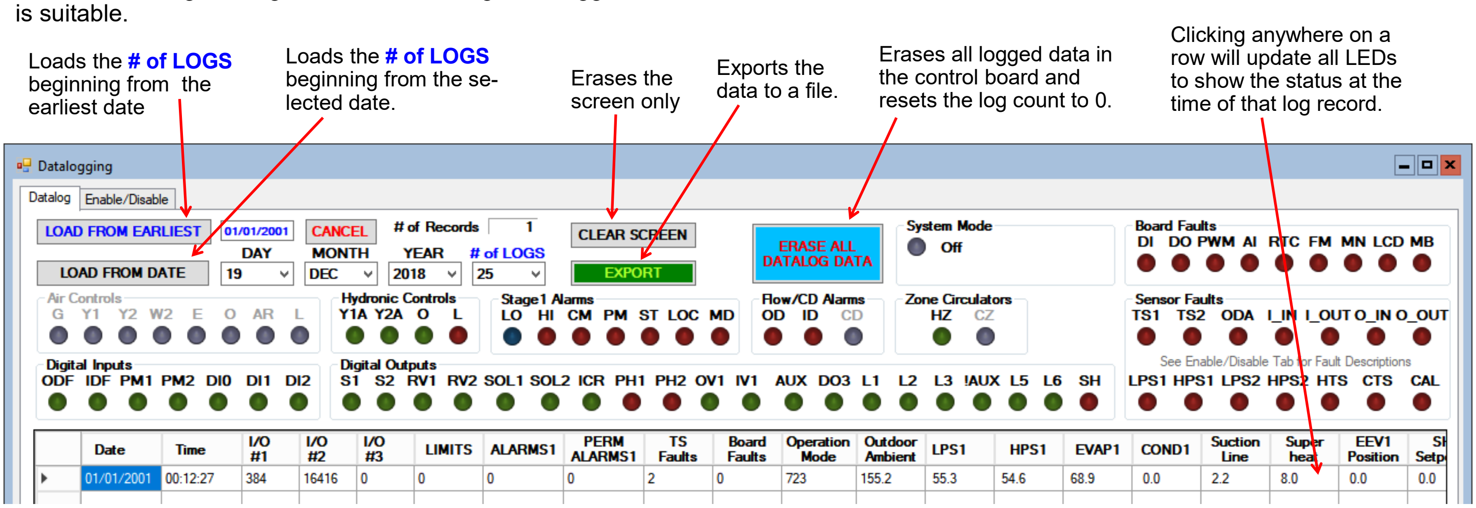
Tools-->Datalogging (Datalog tab):

A log will be automatically recorded at the following rates:

- SYSTEM DISABLED: every 10 minutes
- SYSTEM ENABLED: logging frequency set via the dropdown box at the top right of the PC App main window
- ALARM: logging frequency automatically set to 10 seconds, for 2 hours
- PERMANENT ALARM: every 10 minutes

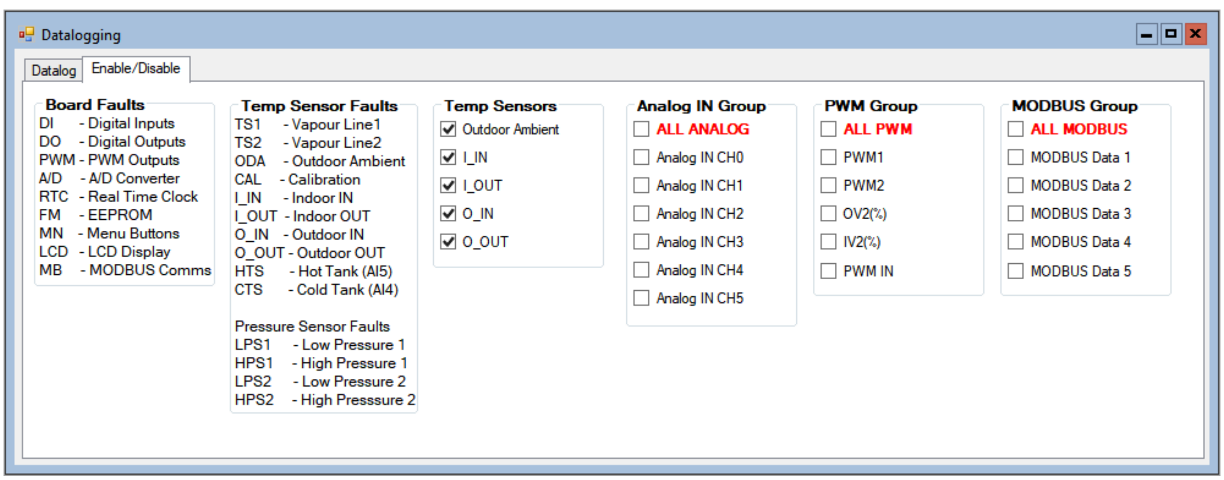
The maximum number of datalog records is 32,224, which will take 45 days to fill up at the default recording rate of 2 minutes.

Note that loading datalogs is time-consuming. It is suggested to leave the ***# of LOGS*** at **25** until it is shown that the start date selected is suitable.



Tools-->Datalogging (Enable/Disable tab):

Click on the checkboxes to customize which columns are shown/hidden in the datalog table. Boxes must be checked to be included in exported data.

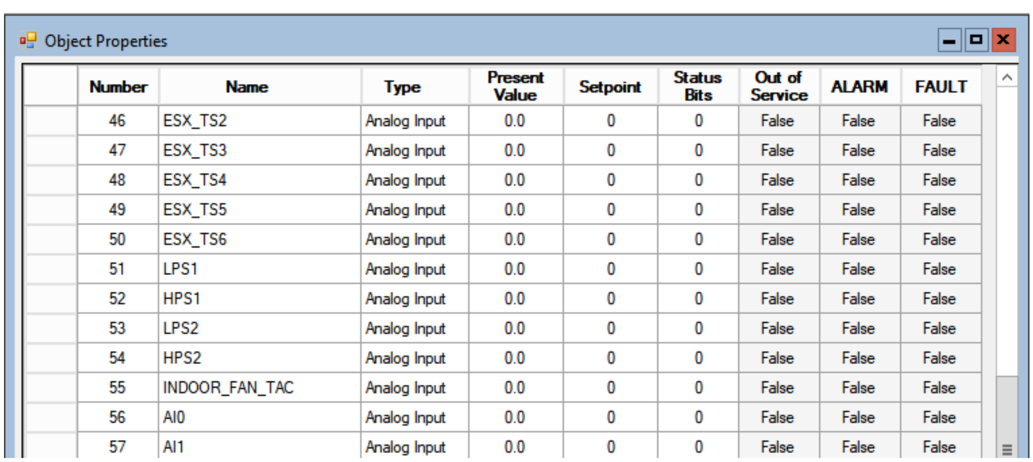


Tools-->MODBUS:

For future use.

Tools-->Objects:

This is a window to display the runtime data, which is not stored when the power is turned off. No changes are possible.


Object Properties

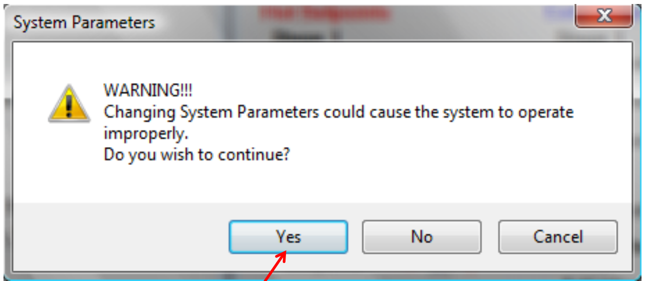
Number	Name	Type	Present Value	Setpoint	Status Bits	Out of Service	ALARM	FAULT
46	ESX_TS2	Analog Input	0.0	0	0	False	False	False
47	ESX_TS3	Analog Input	0.0	0	0	False	False	False
48	ESX_TS4	Analog Input	0.0	0	0	False	False	False
49	ESX_TS5	Analog Input	0.0	0	0	False	False	False
50	ESX_TS6	Analog Input	0.0	0	0	False	False	False
51	LPS1	Analog Input	0.0	0	0	False	False	False
52	HPS1	Analog Input	0.0	0	0	False	False	False
53	LPS2	Analog Input	0.0	0	0	False	False	False
54	HPS2	Analog Input	0.0	0	0	False	False	False
55	INDOOR_FAN_TAC	Analog Input	0.0	0	0	False	False	False
56	AI0	Analog Input	0.0	0	0	False	False	False
57	AI1	Analog Input	0.0	0	0	False	False	False

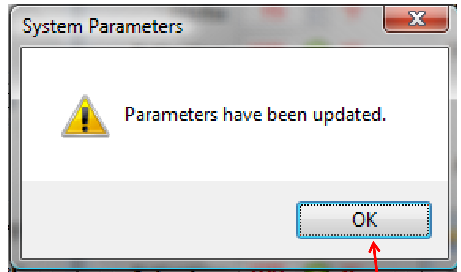
go to TABLE OF CONTENTS

Tools-->Parameters:

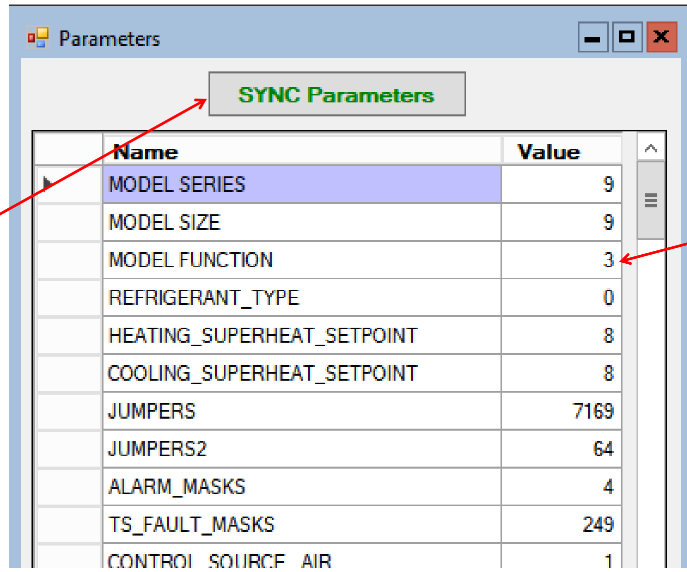
WARNING! The Parameters page is for advanced use only.
Changing parameter values can cause the system to stop functioning properly.

The parameters page shows all configurable memory spaces with their name and current value and allows them to be edited directly. To change a parameter value type in the new value and press ENTER.





Clicking on menu item ***Tools-->Parameters*** will display this warning.
Click on **YES** to open the parameters page.

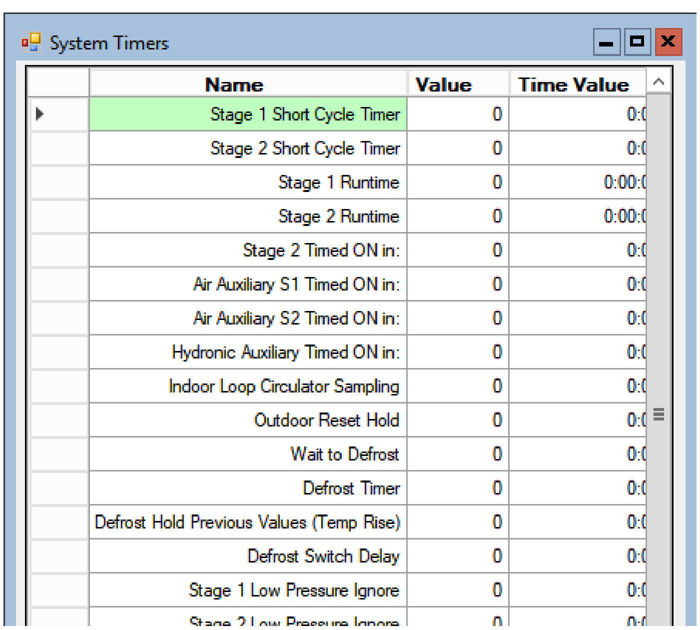


Click this button to reload the table with the values from the control board memory.

Type in the new value and press **ENTER**, the confirmation popup will appear, click on **OK**.

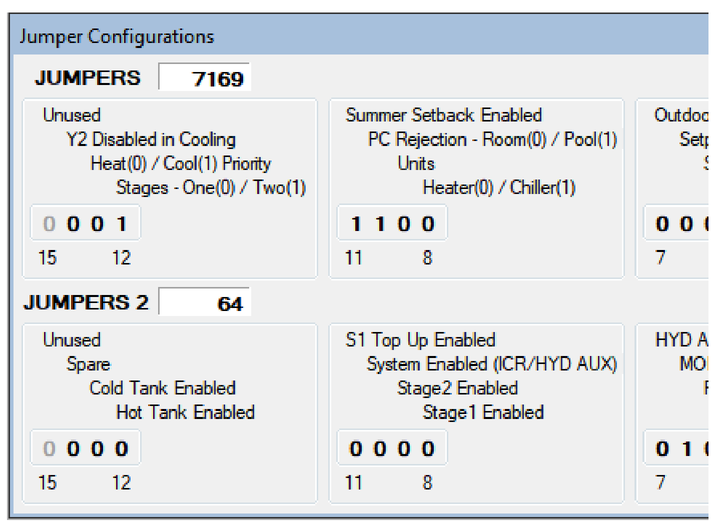
Tools-->SYSTEM TIMERS:

This page shows all internal timers by name along with their current values.



Tools-->Jumpers:

This page shows internal jumper configurations, for developers.

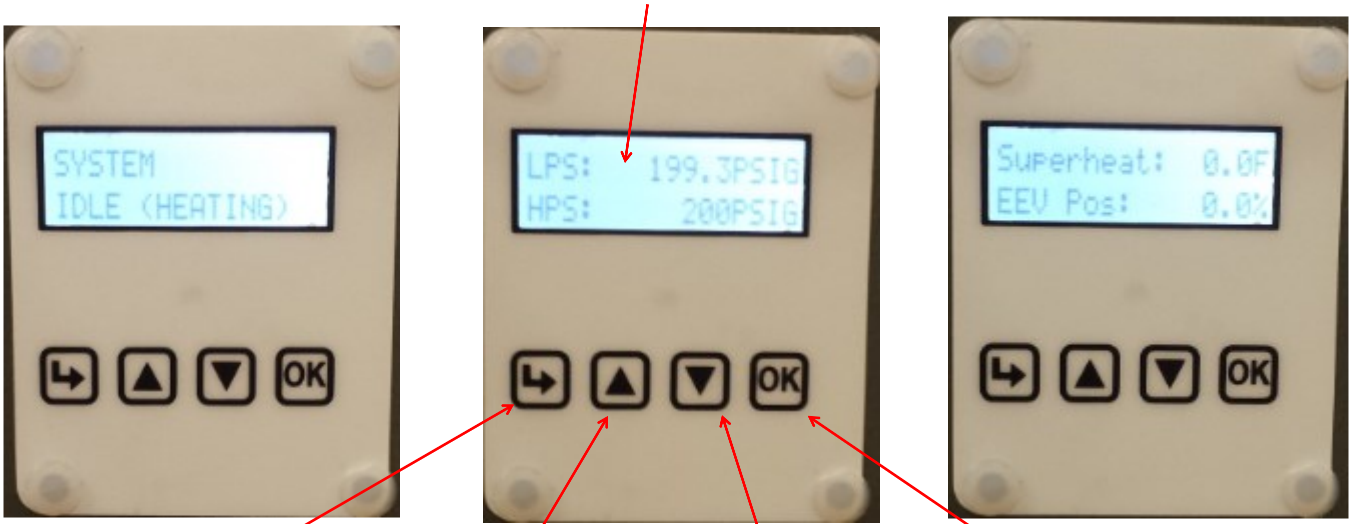


go to TABLE OF CONTENTS

LCD Interface & Menus

These are examples of the unit status and operating data displayed when at the message display level (top level). Pressing ENTER will enter into the menu levels beginning with the Main Menu.

2x16 LCD Display



ENTER button:
Use this to push down to the next menu level. Also saves value if at parameter menu level.

UP button:
Use this to scroll up through the items available at a menu level.

DOWN button:
Use this to scroll down through the items available at a menu level.

OK/EXIT button:
Use this to come back up one menu level. Also saves value if at parameter menu level.

Main Menu: This is a list of the various tools are used for system setup and monitoring.
The table shows what is displayed based on each press of the ENTER button starting at the Main Menu level.

ENTER (From Main)	ENTER (First Press)	ENTER (Second Press)	ENTER (Third Press)	Description
Setpoint Control (only if using Setpoint control)	***— Setpoints***	***— Heating***	***— Stage 1 Setpoint***	Stage 1 stops when water temperature rises to this point.
			— Stage 1 Delta	Stage 1 starts when water temperature drops below setpoint by this amount.
			— Stage 2 Setpoint	Stage 2 stops when water temperature rises to this point.
			— Stage 2 Delta	Stage 2 starts when water temperature drops below setpoint by this amount.
			— AUX (S3) Setpoint	Stage 3 stops when water temperature rises to this point.
			— AUX (S3) Delta	Stage 3 time delay starts when water temperature drops below setpoint by this amount.
			— AUX (S3) Delay	Delays Stage 3 start by timer amount.
			— Outdoor Reset	Outdoor reset factor (diff. between steps)
		— Cooling	***— Stage 1 Setpoint***	Stage 1 stops when water temperature drops to this point.
			— Stage 1 Delta	Stage 1 starts when water temperature rises above setpoint by this amount.
			— Stage 2 Setpoint	Stage 2 stops when water temperature drops to this point.
			— Stage 2 Delta	Stage 2 starts when water temperature rises above setpoint by this amount.
Summer Setback	***— Enable Setback?***	***— Enable***		Enable summer setback.
		— Disable		Disable summer setback.

go to TABLE OF CONTENTS

ENTER (From Main)	ENTER (First Press)	ENTER (Second Press)	ENTER (Third Press)	Description
System EN/DIS	***— STAGE 1 (Bot)***	***— Enable***		Enable compressor 1, auxiliary, and ICR.
		— Disable		Disable compressor 1, auxiliary, and ICR.
	— STAGE 2 (Top)	***— Enable***		Enable compressor 2, auxiliary, and ICR.
		— Disable		Disable compressor 2, auxiliary, and ICR.
Service Mode	***— STAGE 1 (Bot)***	***— No***		Do not enter Service Mode for stage 1.
		— Yes		Enter into Service Mode for stage 1.
	— STAGE 2 (Top)	***— No***		Do not enter Service Mode for stage 2.
		— Yes		Enter into Service Mode for stage 2.
EEV Control	***— EEV1 (Bot)***	***— Auto/Manual***	***— Auto***	Puts EEV1 in Auto mode
			— Manual	Puts EEV1 in Manual mode
		— Manual Position	***— EEV1 Position (%)***	Enter desired EEV1 position
	— EEV2 (Top)	***— Auto/Manual***	***— Auto***	Puts EEV2 in Auto mode
			— Manual	Puts EEV2 in Manual mode
		— Manual Position	***— EEV2 Position (%)***	Enter desired EEV2 position
Configuration	***— Control HYD***	***— Setpoints***		On-board water temperature control - see **Operation** chapter
		— Signals		Hardwired 24VAC signal control
		— BACnet		BACnet control—see **BACnet** chapter
	— Outdoor Reset *(only if using Setpoint Control)*	***— Enable***		Enables Outdoor Reset functionality
		— Disable		Disables Outdoor Reset functionality
	— Outdoor Ambient	***— Enable***		Enables accessory outdoor temp. sensor
		— Disable		Disables accessory outdoor temp. sensor
	— Setpoints Method *(only if using Setpoint Control)*	***— ICR***		Use Indoor Circulator Relay sampling
		— HTS/CTS		Use external temperature sensors
	— Heat Pump / Chiller *(only if using Setpoint Control, H models)*	***— Heat Pump***		Control on indoor loop water temperature
		— Chiller		Control on outdoor loop water temperature
	— Number of Tanks *(for Setpoint control with HTS/CTS, HAC only)*	***— One Tank***		One tank for heating/cooling functions
		— Two Tanks		Separate hot and cold tanks
	— Time Delays	***— Short Cycle***	***— Short Cycle (min)***	Enter short-cycle timer value
		— Heat/Cool	***— Heat/Cool (min)***	Enter minimum off time between modes
	— Units	***— Standard***		Standard units
		— Metric		Metric units (does not affect calibr. units)
	— Set Time	***— Hours***		Set the system hours.
		— Minutes		Set the system minutes.
	— Set Date	***— Day***		Set the system day.
		— Month		Set the system month.
		— Year		Set the system year.
Calibration	***— Suction 1***		Suction 1 pressure	Calibration in 1PSI intervals.
	— Discharge 1		Discharge 1 pressure	Calibration in 1PSI intervals.
	— Vapour Line 1		Suction line 2 temp.	Calibration in 0.1°F intervals
	— Suction 2		Suction 2 pressure	Calibration in 1PSI intervals.
	— Discharge 2		Discharge 2 pressure	Calibration in 1PSI intervals.
	— Vapour Line 2		Suction line 2 temp.	Calibration in 0.1°F intervals
	— Outdoor Ambient		Outside air temp.	Calibration in 0.1°F intervals
	— Outdoor IN Temp		Loop temperature	Calibration in 0.1°F intervals
	— Outdoor OUT Temp		Loop temperature	Calibration in 0.1°F intervals
	— Indoor IN Temp		Loop temperature	Calibration in 0.1°F intervals
	— Indoor OUT Temp		Loop temperature	Calibration in 0.1°F intervals

go to TABLE OF CONTENTS

BACnet Interface

The BACnet interface is an **MS/TP** connection via RS-485 twisted pair. BACnet **IP** is not available.
Recommended wire: 22-24 AWG single twisted pair, 100-120 Ohms impedance, 17pF/ft or lower capacitance, with braided or aluminum foil shield, such as Belden 9841 or 89841.

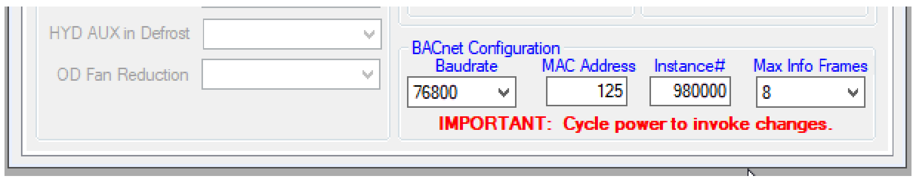
The connector on the control board is a three wire removable screw connector. The signals are as follows:
A: Communications line (+) (right pin)
B: Communications line (-) (middle pin)
C: Ground connection (left pin)

If connecting multiple units to one RS-485 connection point, connect the signal cable from the master building controller to the first unit. Connect the second unit to the first unit (in same connector), connect the third unit to the second unit, and so on until all units are connected (daisy-chain). Remove the TERM jumper (located just above the BACnet connector on control board) from all units except the last one. The shield ground should be connected only to the GND pin of the unit for single unit installations. For multiple units, the shield ground should only be connected to the GND pin of the last unit. The shield grounds for intermediate units should be connected together. The shield ground should be left unconnected at the building controller end for all cases.

Vendor: Maritime Geothermal Ltd.
Vendor ID: 260
Model Name: MGT GEN2 Control Board

The following parameters can be set via the PC App's *Configuration* Window:

1) **Baud rate**
   9600, 19200, 38400, or 76800
2) **MAC address**
   Maximum value is 125.
3) **Instance number**
   Maximum value is 4194303.



The BACnet parameter **Max_Master** has a fixed value of **127** in this device.

BACnet data is available regardless of the selected control method. In order to control the unit via the BACnet interface, set **Control Source** to ***BACnet*** either by using the PC App's configuration window or the LCD menus.

TABLE 15 - BACnet OBJECTS - CONTROL SIGNALS (READ/WRITE)

Name	Data Type	ID	Property	Description
SYSTEM_Y1A	Binary Value	BV0	Present Value	Stage 1 - bottom compressor (active is on)
SYSTEM_Y2A	Binary Value	BV1	Present Value	Stage 2 - top compressor (active is on)
SYSTEM_O	Binary Value	BV2	Present Value	Reversing valve. Inactive=HEATING, Active=COOLING (HAC units only)
BACnet_Units	Binary Value	BV9	Present Value	Select units for BACnet objects. OFF=US standard, ON=metric

TABLE 16 - BACnet OBJECTS - OPERATION MODE Description (Read Only)

Name	Data Type	ID	Present Value	Description
Operation Mode	Analog Value	**AV5**	2	Hydronic heating
			3	Hydronic cooling (HAC units only)
			11	Hydronic heating OFF
			12	Hydronic cooling OFF (HAC units only)
Note: Object is type Analog Value but value will always be an integer value.				

TABLE 17 - BACnet OBJECTS - LIMITS Description (Read Only)

Name	ID	BIT #	Decimal Value*	Bit Description
Limits (Present Value)	**AV6**	0	1	Low Indoor OUT temperature
		1	2	High Indoor OUT temperature
		2	4	Low Outdoor OUT temperature
		3	8	High Outdoor OUT temperature
Note: Limits object is type Analog Value but value is bit coded and may be decoded as such (integer value). Note * : Value is for a single alarm and reference only.				

Note: object names are subject to change without prior notice.

go to TABLE OF CONTENTS

TABLE 18 - BACnet OBJECTS - DATA (Read Only)					
	Name	ID	Property	Units	Description
Type - Analog Input	AI0 (Comp1_Current)	AI0	Present Value	Amps	Stage 1 compressor current draw (AI0)
	AI1 (Comp2_Current)	AI1	Present Value	User	Stage 2 compressor current draw (AI1)
	AI2	AI2	Present Value	User	User defined (0-5VDC or 4-20mA)
	AI3	AI3	Present Value	User	User defined (0-5VDC or 4-20mA)
	AI4 (CTS)	AI4	Present Value	degF (degC)	Cold tank temperature from sensor - requires accessory
	AI5 (HTS)	AI5	Present Value	degF (degC)	Hot tank temperature from sensor - requires accessory
	LPS1	AI6	Present Value	PSIG (kPa)	Stage 1 low pressure value (suction pressure)
	HPS1	AI7	Present Value	PSIG (kPa)	Stage 1 high pressure value (discharge pressure)
	EVAP1	AI8	Present Value	degF (degC)	Stage 1 evaporating Temperature
	COND1	AI9	Present Value	degF (degC)	Stage 1 condensing Temperature
	Suction Line 1	AI10	Present Value	degF (degC)	Stage 1 suction line temperature
	Superheat 1	AI11	**Setpoint Value**	degF (degC)	Stage 1 superheat
	EEV1 Position	AI12	Present Value	%	Stage 1 EEV position (% open)
	LPS2	AI13	Present Value	PSIG (kPa)	Stage 2 low pressure value (suction pressure)
	HPS2	AI14	Present Value	PSIG (kPa)	Stage 2 high pressure value (discharge pressure)
	EVAP2	AI15	Present Value	degF (degC)	Stage 2 evaporating Temperature
	COND2	AI16	**Setpoint Value**	degF (degC)	Stage 2 condensing Temperature
	Suction Line 2	AI17	Present Value	degF (degC)	Stage 2 suction line temperature
	Superheat 2	AI18	**Setpoint Value**	degF (degC)	Stage 2 superheat
	EEV2 Position	AI19	Present Value	%	Stage 2 EEV position (% open)
	Outside Ambient	AI20	Present Value	degF (degC)	Outdoor ambient temperature - requires accessory
	O_IN	AI21	Present Value	degF (degC)	Outdoor IN temperature
	O_OUT	AI22	Present Value	degF (degC)	Outdoor OUT temperature
	I_IN	AI23	Present Value	degF (degC)	Indoor IN temperature
	I_OUT	AI24	Present Value	degF (degC)	Indoor OUT temperature
Type - Analog Value	PWM_IN	AV0	Present Value	%	PWM input (from external source)
	PWM1 (OD Fan)	AV1	Present Value	%	PWM output value (spare)
	PWM2	AV2	Present Value	%	PWM output value (spare)
	PWM3 (OV2)	AV3	Present Value	%	OV2 - PWM or 0-10VDC for outdoor loop water valve
	PWM4 (IV2)	AV4	Present Value	%	IV2 - PWM or 0-10VDC for indoor loop water valve
	Operation Mode	AV5	Present Value	N/A	Description of mode - see Operation Mode Description table
	Limits description	AV6	Present Value	N/A	Description of active limits - see Limits Description table
	Permanent Alarms 1	AV7	Present Value	N/A	Descr. of active stg 1 alarms - see Alarm Descriptions table
	Permanent Alarms 2	AV8	Present Value	N/A	Descr. of active stg 2 alarms - see Alarm Descriptions table
	Board Faults	AV9	Present Value	N/A	Description of active faults - see Fault Descriptions table
	Sensor Faults	AV10	Present Value	N/A	Description of active faults - see Fault Descriptions table
Type - Binary Output	STAGE1	BO0	Present Value	N/A	Stage 1 compressor contactor
	STAGE2	BO1	Present Value	N/A	Stage 2 compressor contactor
	ICR (Indoor Circ)	BO2	Present Value	N/A	Indoor circulator control
	DO0 (OV1)	BO3	Present Value	N/A	OV1 - 24VAC for outdoor loop water valve
	DO1 (IV1)	BO4	Present Value	N/A	IV1 - 24VAC for indoor loop water valve
	DO2 (HYD_AUX)	BO5	Present Value	N/A	Hydronic Auxiliary
	DO3 (AUX_ONLY)	BO6	Present Value	N/A	N/A
	PHS1	BO7	Present Value	N/A	Stage 1 dry contact pin for locked out on alarm
	PHS2	BO8	Present Value	N/A	Stage 2 dry contact pin for locked out on alarm
Type - Binary Value	CONTROLS	BV9	Present Value	N/A	Control indicator: 0=local (man.override), 1=remote (BACnet)
	Outdoor Flow	BV10	Present Value	N/A	Outdoor Loop flow switch
	Indoor Flow	BV11	Present Value	N/A	Indoor Loop flow switch (reversing models only)
	Phase Monitor1	BV12	Present Value	N/A	Stage 1 3-phase monitor
	Phase Monitor2	BV13	Present Value	N/A	Stage 2 3-phase monitor
	Comp Monitor1	BV14	Present Value	N/A	Stage 1 compressor monitor
	Comp Monitor2	BV15	Present Value	N/A	Stage 2 compressor monitor

go to TABLE OF CONTENTS

TABLE 19 - BACnet OBJECTS - ALARM Descriptions (Read Only)

Name	Data Type	ID	Description
AI0 (Comp1 Current)	Analog Input	AI0	Stage 1 status alarm (start / stop failure, from current sensor)
AI1 (Comp2 Current)	Analog Input	AI1	Stage 2 status alarm (start / stop failure, from current sensor)
LPS1	Analog Input	AI6	Stage 1 low pressure alarm
HPS1	Analog Input	AI7	Stage 1 high pressure alarm
LPS2	Analog Input	AI13	Stage 2 low pressure alarm
HPS2	Analog Input	AI14	Stage 2 high pressure alarm
Outdoor Flow	Binary Value	BV10	Outdoor loop flow alarm
Indoor Flow	Binary Value	BV11	Indoor loop flow alarm (HAC models only)
Phase Monitor1	Binary Value	BV12	Stage 1 3-phase monitor alarm
Phase Monitor2	Binary Value	BV13	Stage 2 3-phase monitor alarm
Comp Monitor1	Binary Value	BV14	Stage 1 compressor monitor alarm (from compressor protection module)
Comp Monitor2	Binary Value	BV15	Stage 2 compressor monitor alarm (from compressor protection module)

Name	ID	BIT #	Decimal Value*	Bit Description
Permanent Alarms 1 (Present Value)	**AV7**	0	1	Stage 1 master permanent alarm (occurs when any alarm occurs)
		1	3	Stage 1 low pressure heating mode alarm (suction pressure)
		2	5	Stage 1 low pressure cooling mode alarm (suction pressure)
		3	9	Stage 1 high pressure heating mode alarm (discharge pressure)
		4	17	Stage 1 high pressure cooling mode alarm (discharge pressure)
		5	33	Stage 1 loss of charge alarm
		6	65	Stage 1 3-phase monitor alarm
		7	129	Stage 1 compressor monitor alarm (from compressor prot. module)
		8	257	Stage 1 status alarm (start / stop failure, from current sensor)
		14	16,385	Outdoor loop flow alarm
		15*	32,769	Indoor loop flow alarm (reversing models only)
Permanent Alarms 2 (Present Value)	**AV8**	0	1	Stage 2 master permanent alarm (occurs when any alarm occurs)
		1	3	Stage 2 low pressure heating mode alarm (suction pressure)
		2	5	Stage 2 low pressure cooling mode alarm (suction pressure)
		3	9	Stage 2 high pressure heating mode alarm (discharge pressure)
		4	17	Stage 2 high pressure cooling mode alarm (discharge pressure)
		5	33	Stage 2 loss of charge alarm
		6	65	Stage 2 3-phase monitor alarm
		7	129	Stage 2 compressor monitor alarm (from compressor prot. module)
		8	257	Stage 2 status alarm (start / stop failure, from current sensor)
		14	16,385	Outdoor loop flow alarm
		15*	32,769	Indoor loop flow alarm (reversing models only)

Note: Permanent Alarm objects are type Analog Value but values are bit coded and may be decoded as such (integer value).
Note * : Value is for a single alarm and reference only. Value includes + 1 for Master Alarm

Note: object names are subject to change without prior notice.

go to TABLE OF CONTENTS

TABLE 20 - BACnet OBJECTS - FAULT Descriptions (Read Only)			
Name	**Data Type**	**ID**	**Description**
AI4 (Cold Tank)	Analog Input	AI0	Cold tank temperature sensor faulty or disconnected - requires accessory
AI5 (Hot Tank)	Analog Input	AI1	Hot tank temperature sensor faulty or disconnected - requires accessory
LPS1	Analog Input	AI6	Stage 1 low pressure sensor faulty or disconnected
HPS1	Analog Input	AI7	Stage 1 high pressure sensor faulty or disconnected
LPS2	Analog Input	AI13	Stage 2 low pressure sensor faulty or disconnected
HPS2	Analog Input	AI14	Stage 2 high pressure sensor faulty or disconnected
Suction Line1	Analog Input	AI10	Stage 1 suction line temperature sensor faulty or disconnected
Suction Line2	Analog Input	AI17	Stage 2 suction line temperature sensor faulty or disconnected
Outside Ambient	Analog Input	AI20	Outside temperature sensor faulty or disconnected - requires accessory
O_IN	Analog Input	AI21	Outdoor IN temperature sensor faulty or disconnected
O_OUT	Analog Input	AI22	Outdoor OUT temperature sensor faulty or disconnected
I_IN	Analog Input	AI23	Indoor IN temperature sensor faulty or disconnected
I_OUT	Analog Input	AI24	Indoor OUT temperature sensor faulty or disconnected

Name	ID	BIT #	Decimal Value*	Bit Description
Board Faults (Present Value)	**AV9**	0	1	Digital inputs
		1	2	Digital outputs
		2	4	PWM outputs
		3	8	Analog to digital conversion
		4	16	Real time clock
		5	32	EEPROM memory
		6	64	Menu buttons
		7	128	LCD interface
Sensor Faults (Present Value)	**AV10**	0	1	Stage 1 suction line temperature sensor
		1	2	Stage 2 suction line temperature sensor
		2	4	Outdoor Ambient temperature sensor - accessory
		3	8	Calibration temperature resistor plug
		4	16	Indoor IN temperature sensor
		5	32	Indoor OUT temperature sensor
		6	64	Outdoor IN temperature sensor
		7	128	Outdoor OUT temperature sensor
		8	256	Cold tank temperature sensor on AI4 - accessory
		9	512	Hot tank temperature sensor on AI5 - accessory
Note: Board and Sensor Fault objects are type Analog Value but values are bit coded and may be decoded as such (integer value). Note * : Value is for a single fault and reference only.				

Note: object names are subject to change without prior notice.

go to TABLE OF CONTENTS

Startup Procedure

The W/WH-Series Startup Record located in this manual is used in conjunction with this startup procedure to provide a detailed record of the installation. A completed copy should be left on site, a copy kept on file by the installer, and a copy should be sent to Maritime Geothermal Ltd..

Check the boxes or fill in the data as each step is completed. For data boxes, circle the appropriate units.

Pre-Start Inspection

Indoor Loop (Hydronic Loop):

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the indoor loop, and that full flow is available to the heat pump.
2. Verify that the entire system has been flooded and all the air has been purged as much as possible. Further purging may be required after the system has been operating for a while.
3. Verify that the loop contains the proper mix of antifreeze (if used) for the intended application. If applicable, record the type of antifreeze and the mixture value on the startup sheet, circle % Vol. or % Weight.
4. Record the static loop pressure on the startup sheet.

Outdoor Loop (Ground Loop):

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the ground loop, and that full flow is available to the heat pump.
2. Verify that the entire system has been flooded and all the air has been purged as much as possible. Further purging may be required after the system has been operating for a while.
3. Verify that the loop contains the proper mix of antifreeze for the intended application. Record the type of antifreeze and the mixture value on the startup sheet; circle % Vol. or % Weight.
4. Record the static loop pressure on the startup sheet.

Outdoor Loop (Ground Water):

1. Verify there are no leaks in the connections to the unit. Verify the water valve is installed and properly oriented in the OUT line.
2. Verify that there is flow control in the OUT line.

Electrical:

1. **Ensure the power to the unit is off.**
2. Verify all high voltage connections. Ensure that there are no stray wire strands, all connections are tight, and the ground wire is connected tightly to the ground connector.
3. Record the circuit breaker size and wire gauge for the heat pump.
4. Verify that the control connections to the unit are properly connected and all control signals are off, so that the unit will not start up when the power is turned on.
5. Verify that the circulator pumps are connected to the proper voltages. Record the voltages of the circulator pumps.
6. Ensure all access panels except the one that provides access to the electrical box are in place.

go to TABLE OF CONTENTS

Unit Startup

The unit is now ready to be started. The steps below outline the procedure for starting the unit and verifying proper operation of the unit. **It is recommended that safety glasses be worn during the following procedures.**

IMPORTANT NOTE: The unit is shipped with *Stage 1* and *Stage 2 Disabled* in order to prevent the unit from starting when the power is first turned on. Follow the instructions below in the Preparation section to enable the compressors.

The LCD will automatically scroll through various data including low (suction) pressure, high (discharge) pressure, superheat, EEV position and water in/out temperatures.

Preparation:

1. Set all controls (including zone thermostats) to OFF. Turn power on to the heat pump. All LED's on the control board should turn on, the LCD interface should say "**MGT GEN2 VERx.xx**" on line 1 and "**Zeroing EEV's**" on line 2. You should be able to hear the EEV moving (a clicking sound).
2. Measure the following voltages on the compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.
3. Connect a USB cable between the USB connector on the board and a laptop with the PC App installed (recommended but optional).
4. Select the desired *Control Source HYD* via the PC APP or Configuration Menu.
5. Enable the system either from the Configuration Page of the PC APP or through the menu buttons.

Heating Mode:

1. Adjust the Setpoint Control settings via the PC App or LCD to activate stage 1 and stage 2 (or activate via BACnet or 24V signal if used). The EEV's will begin to open and the compressors will start, as will the circulator pumps.
2. Check the PC App or LCD. The suction and discharge pressures will vary based on the outdoor loop temperature and the indoor loop temperature, but for a typical startup they should be **90-110 psig** and **260-360 psig** for W-series or **25-35 psig** and **105-200 psig** for WH-series.
3. Monitor the unit via the PC APP or LCD Interface while the unit runs, and record the following after 10 minutes of run time:
    1. Suction pressure (both stages)
    2. Discharge pressure (both stages)
    3. Indoor Loop In (Hot In) temperature
    4. Indoor Loop Out (Hot Out) temperature
    5. Indoor Delta T (should be **8-12°F, 4-6°C**)
    6. Indoor flow (if available)
    7. Outdoor Loop In (Supply In) temperature
    8. Outdoor Loop Out (Supply Out) temperature
    9. Outdoor Delta T (should be **5-8°F, 3-4°C**)
    10. Outdoor flow (if available)
    11. Compressor L1(C) current (black wire, place meter between electrical box and compressor)

4. Adjust the control setpoints to the desired buffer tank temperature and let the unit run through a cycle.

Cooling Mode:

1. Set the unit to cooling mode and adjust the cooling control setpoints to activate Stage 1 and Stage 2.
2. Monitoring the unit via the PC APP or LCD interface while the unit runs, and record the following after 10 minutes of run time:
    1. Suction pressure (both stages)
    2. Discharge pressure (both stages)
    3. Indoor Loop In temperature
    4. Indoor Loop Out temperature
    5. Indoor Delta T
    6. Outdoor Loop In (Supply In) temperature
    7. Outdoor Loop Out (Supply Out) temperature
    8. Outdoor Delta T

3. Adjust the cooling control setpoints to the desired tank temperature, and allow the unit to run through a cycle.

Final Inspection:

1. Turn the power off to the unit and remove all test equipment.
2. Install the electrical box cover and the access panel on the heat pump. Install the service port caps securely to prevent refrigerant loss.
3. Do a final check for leaks in the Indoor Loop piping and ensure the area is clean.
4. Turn the power on to the unit. Set the Setpoints Control (or aquastat) to the final settings and record the values.

Startup Record:

1. Sign and date the Startup Record and have the site personnel sign as well. Leave the Startup Record with the site personnel, retain a copy for filing and send a copy to Maritime Geothermal Ltd. for warranty registration.

go to TABLE OF CONTENTS

Startup Record Sheet - Commercial W/WH-Series

Installation Site		**Startup Date**	**Installer**	
City			**Company**	
Province		**Check boxes unless asked to record data. Circle data units.**	**Model**	
Country			**Serial #**	
Client Name		**Site Owner Phone #**		

PRE-START INSPECTION

Indoor Loop (Hydronic)	All shut-off valve are open (full flow available)							
	Loop is full and purged of air							
	Antifreeze type/concentration		% Volume		% Weight			
	Loop static pressure		psig	kPa				
Ground Loop System	All shut-off valve are open (full flow available)							
	Loop is full and purged of air							
	Antifreeze type/concentration		% Volume		% Weight			
	Loop static pressure		psig	kPa				
Ground Water System	Water valve installed in OUT line							
	Flow control installed in OUT line							
Electrical	High voltage connections are correct and securely fastened							
	Circuit breaker (or fuse) size and wire gauge for Heat Pump		A		Ga.			
	Circulator pump voltages (Outdoor 1, Outdoor 2, Indoor 1)		V		V		V	
	Low voltage connections are correct and securely fastened							

STARTUP DATA

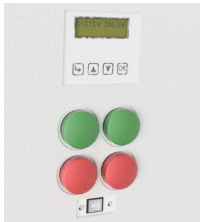
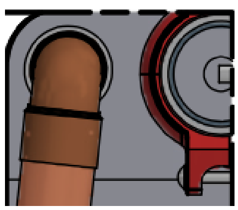
Preparation	Voltage across L1 and L2, L1 and L3, L2 and L3							VAC
Heating Mode (10 minutes)	Stage 1 Suction Pressure / Discharge Pressure					psig	kPa	
	Stage 2 Suction Pressure / Discharge Pressure					psig	kPa	
	Indoor In (Hot In), Indoor Out (Hot Out), and Delta T		In		Out		°F	°C
	Outdoor In (Supply In), Outdoor Out (Supply Out), and Delta T		In		Out		°F	°C
	Outdoor Flow		igpm	gpm		L/s		
	Compressor L1 (black wire) current		A					
	Heating setpoint and discharge pressure at cycle end		°F	°C		psig	kPa	
Cooling Mode (HAC only) (10 minutes)	Stage 1 Suction Pressure / Discharge Pressure					psig	kPa	
	Stage 2 Suction Pressure / Discharge Pressure					psig	kPa	
	Indoor In (Hot In), Indoor Out (Hot Out), and Delta T		In		Out		°F	°C
	Outdoor In (Supply In), Outdoor Out (Supply Out), and Delta T		In		Out		°F	°C
	Cooling setpoint and suction pressure at cycle end		°F	°C		psig	kPa	
Final Control Settings	Heating S1 Setpoint, S1 Delta			°F	°C			
	Heating S2 Setpoint, S2 Delta			°F	°C			
	Heating S3 Setpoint, S3 Delta, S3 Time Delay			°F	°C		min	
	Cooling S1 Setpoint, S1 Delta			°F	°C			
	Cooling S2 Setpoint, S2 Delta			°F	°C			

Date:		**Installer Signature:**		**Client Signature:**	

A total of three copies are required, one for the site, one for the installer/startup and one to be sent to Maritime Geothermal Ltd.

go to TABLE OF CONTENTS

Routine Maintenance

MAINTENANCE SCHEDULE			
Item		**Interval**	**Procedure**
LCD Interface or **Status Lights** or **PC App via USB**		Weekly (optional, if alarms are not reported through a BACnet system)	Check for alarms and faults. Rectify problem if alarms found. See **Troubleshooting** chapter.
Strainers		Monthly (more frequently immediately after initial startup)	Inspect and clean if necessary.
Compressor Contactors		1 year	Inspect for pitted / burned points or loose wires. If necessary, replace contactor or tighten wires.
Heat Exchangers		When experiencing performance degradation that is not explained by a refrigeration circuit problem or low loop flow rate	Disconnect the affected loop and flush heat exchanger with a lime removing solution. Generally not required for closed loop or cold water open loop systems; whenever system performance is reduced for warm water open loop systems.

go to TABLE OF CONTENTS

Troubleshooting Guide

The following steps are for troubleshooting the heat pump. Repair procedures and reference refrigeration circuit diagrams can be found later in this manual.

STEP 1: Verify that the LCD Interface is functioning . If it is not, proceed to POWER SUPPLY TROUBLE SHOOTING, otherwise proceed to STEP 2.

STEP 2: Record the alarm shown on the LCD Interface or use the PC APP Alarms page to determine the alarm type. Proceed to the ALARMS TROUBLESHOOTING section.

STEP 3: If there are no alarms and STAGE1 is showing as on (LCD Interface, PC APP or LED on control board) but the compressor is not operating, does not attempt to start, attempts to start but cannot, starts hard, or starts but does not sound normal, proceed to the COMPRESSOR TROUBLESHOOTING section.

STEP 4: If the compressor starts and sounds normal, this means the compressor is most likely OK. Proceed to the OPERATION TROUBLESHOOTING section.

NOTE: To speed up the troubleshooting process, if using the **PC Application**, click on ***SC Override*** to reduce the short cycle timer to 10 seconds.

POWER SUPPLY TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
No power to the heat pump	Disconnect switch open (if installed)	Verify disconnect switch is in the ON position.	Determine why the disconnect switch was opened; if all is OK close the switch.
	Fuse blown / breaker tripped	At heat pump disconnect box, voltmeter shows 208-575VAC on the line side but not on the load side.	Reset breaker or replace fuse with proper size and type. (Time-delay type "D")
No heartbeat on control board	Transformer breaker tripped (or fuse blown for those without breaker)	Breaker on transformer is sticking out (or fuse looks burnt).	Push breaker back in. If it trips again locate cause of short circuit and correct (or replace fuse) .
	Faulty transformer	Transformer breaker is not tripped (or fuse not blown), 208-575VAC is present across L1 and L3 of the compressor contactor but 24VAC is not present across 24VAC and COM of the control board.	Replace transformer.
	Faulty control board	24VAC is present across 24VAC and COM of the control board.	Replace the control board.
No display on aquastat (if used)	No power from transformer	See **No heartbeat on control board**.	
	Faulty wiring between heat pump and aquastat	24VAC is not present across 24V and COM of the aquastat.	Correct the wiring.
	Faulty aquastat	24VAC is present across COM and 24V of the aquastat but aquastat has no display.	Replace aquastat.

go to TABLE OF CONTENTS

ALARM TROUBLESHOOTING		
Alarm/Fault	**Description**	**Recommended Action**
Note that the data logging function of the GEN2 Control Board is a very useful tool for troubleshooting alarms. It provides a history of the unit operation up to and including the time at which the alarm(s) occurred.		
Low Pressure (Stage 1 or Stage 2)	A low pressure alarm occurs when the suction pressure drops to or below the ***Low Pressure Cutout*** value. The low pressure is checked just before a compressor start; if it is OK the compressor will start, otherwise an alarm will occur. When the compressor starts, a low pressure condition will be ignored for the number of seconds that ***Low Pressure Ignore*** is set to, after which the low pressure alarm will be re-enabled. This allows a dip in suction pressure below the cutout point during startup without causing a nuisance alarm.	Go to the Low Pressure section of the mode the unit was operating in at the time of the alarm.
High Pressure (Stage 1 or Stage 2)	A high pressure alarm occurs when the discharge pressure rises to or above the ***High Pressure Cutout*** Value.	Go to the High Pressure section of the mode the unit was operating in at the time of the alarm.
Compressor Monitor (Stage 1 or Stage 2) <<W240+ ONLY>>	This alarm occurs when the compressor protection module (if present) sends a fault signal to the control board, generally due to the compressor windings overheating.	Go to Compressor section.
Compressor Status (Stage 1 or Stage 2)	This alarm occurs when there is a current draw on the compressor as measured by the current sensor but no call for the compressor to be on (i.e. welded contactor) or when there is a call for the compressor to be on but there is no compressor current draw (i.e. manual high pressure control is open or contactor failure).	Check contactor if compressor is staying on when it should be off. Go to Compressor section if compressor is not on when it should be. Also check for tripped manual high pressure control.
Phase Monitor (Stage 1 or Stage 2)	This alarm occurs when the 3-phase monitor detects a fault condition and sends a fault signal to the control board. For three phase units only.	Verify power supply for under/over voltages as well as phase balance. Check compressor contactors for pits or burns. Also check for tripped manual high pressure control.
Comp. Not Pumping (Stage 1 or Stage 2)	Discharge pressure is less than 30 psi higher than suction pressure after 2 minutes run time. It indicates leaking reversing valve, compressor very hot and tripped on internal overload, manual high pressure control trip, bad contactor, or defective compressor.	Check for reversing valve not seated properly, tripped manual high pressure control, or a contactor or compressor problem.
Low Charge / EEV (Stage 1 or Stage 2)	EEV position has been above 99% for 20 minutes within the first hour of cycle.	Check system for refrigerant leak. Also check that EEV for proper operation (see **EEV Troubleshooting** section)
LOC [Loss of Charge] **(Stage 1 or Stage 2)**	This alarm occurs if the low pressure and/or high pressure sensors are below 30 psig (207 kPa).	Check system for refrigerant leak. Check for incorrect pressure sensor reading.
Outdoor Flow	Low or no outdoor loop flow from flow switch. Ignored on compressor start for number of seconds the Outdoor Flow ***Ignore on Start*** is set to. Alarm monitoring will begin when timer expires.	Check outdoor flow switch. Check outdoor loop flow.
Indoor Flow	Reversing -HAC units only: low or no indoor loop flow from flow switch. Ignored on compressor start for number of seconds the Indoor Flow ***Ignore on Start*** is set to. Alarm monitoring will begin when timer expires.	Check indoor flow switch. Check indoor loop flow.

go to TABLE OF CONTENTS

FAULT TROUBLESHOOTING

Alarm/Fault	Description	Recommended Action
Digital Inputs	A failure has occurred and the indicated section of the control board may no longer work properly.	Cycle the power a few times; if the fault persists replace the control board.
Digital Outputs		
Analog Inputs		
MODBUS Comms		
PWM Outputs		
Real Time Clock		
Flash Memory	A failure has occurred and stored data may be corrupt.	It may be possible to correct this by using the menu item ***Tools—Reset to Factory Defaults***. If this clears the fault then the system configuration will have to be set up again.
Menu Buttons	A failure has occurred and the control board may no longer respond to menu button key presses.	Try turning off the power, disconnecting and reconnecting the cable between the LCD Interface board and the Control Board, and then turning the power back on again. If this does not work then either the LDC Display board, the cable, or the driver section of the Control Board may be faulty.
LCD Interface	A failure has occurred and display may show erratic data, no data or may not turn on at all.	
BACnet Comms	BACnet communications experienced a timeout.	See below.
Pressure Sensors	The sensor is reading outside of the acceptable range. Check to ensure connector is on securely.	Replace the pressure sensor. If this does not rectify the problem, replace the control board.
Temperature Sensors	The sensor is reading outside of the acceptable range. Check to ensure connector is on securely.	Replace the temperature sensor. If this does not rectify the problem, replace the control board.

BACnet TROUBLESHOOTING

Fault	Possible Cause	Verification	Recommended Action
BACnet communications not working properly **Or** **BACnet FAULT indication**	Selected baud rate does not match building control system.	Check baud rate of system.	Adjust BACnet parameters in the PC App's **Tools-->Configuration** window. **Cycle power to invoke any changes.**
	Selected MAC address and/or Instance # conflict with other devices on the network.	Check MAC address and Instance # in relation to other system devices.	
	BACnet wiring or termination problem.	Verify correct twisted pair wire and termination in the **BACnet Interface** chapter (earlier).	Correct wiring.
	Hardware problem on heat pump control board.	Remove BACnet connector from board as well as jumper from TERM (located just above the BACnet connector). Using a multimeter set to DC volts with negative probe on **B** and positive probe on **A**, confirm there is **+2.5VDC**.	Replace board if voltage not correct.

go to TABLE OF CONTENTS

COMPRESSOR TROUBLESHOOTING			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Compressor will not start	Faulty control board	No 24vac output on STAGE1 or STAGE2 when compressor should be operating.	Replace control board.
	Faulty run capacitor (Single phase only)	Check value with capacitance meter. Should match label on capacitor. Compressor will hum while trying to start and then trip its overload.	Replace if faulty.
	Loose or faulty wiring	Check all compressor wiring, including inside compressor electrical box.	Fix any loose connections. Replace any damaged wires.
	Faulty compressor contactor	Voltage on line side with contactor held closed, but no voltage on one or both terminals on the load side. Points pitted or burned. Or, 24VAC across coil but contactor will not engage.	Replace contactor.
	Thermal overload on compressor tripped	Ohmmeter shows reading when placed across R and S terminals and infinity between C & R or C & S. A valid resistance reading is present again after the compressor has cooled down.	Proceed to Operation Troubleshooting (particularly *high suction pressure* and *high discharge pressure*) to determine the cause of the thermal overload trip.
	Burned out motor (open winding)	Remove wires from compressor. Ohmmeter shows infinite resistance between any two terminals Note: Be sure compressor overload has had a chance to reset. If compressor is hot this may take several hours.	Replace the compressor.
	Burned out motor (shorted windings)	Remove wires from compressor. Resistance between any two terminals is below the specified value.	Replace the compressor.
	Motor shorted to ground	Remove wires from compressor. Verify infinite resistance between each terminal and ground.	If any terminal to ground is not infinite replace the compressor.
	Seized compressor due to locked or damaged mechanism	Compressor attempts to start but trips its internal overload after a few seconds. (Run capacitor already verified for single phase units.)	Attempt to “rock” compressor free. If normal operation cannot be established, replace compressor.
Compressor starts hard	Start capacitor faulty (Single phase only)	Check with capacitance meter. Check for black residue around blowout hole on top of capacitor.	Replace if faulty. Remove black residue in electrical box if any.
	Potential Relay faulty (Single phase only)	Replace with new one and verify compressor starts properly.	Replace if faulty.
	Compressor is “tight” due to damaged mechanism	Compressor attempts to start but trips its internal overload after a few seconds. Run capacitor has been verified already.	Attempt to “rock” compressor free. If normal operation cannot be established, replace compressor.

go to TABLE OF CONTENTS

OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High or low suction or discharge pressure	Faulty sensor	Compare pressure sensor reading against a known reference such as a new refrigeration manifold set.	Check wiring, replace sensor. If problem persists replace control board.
High Discharge Pressure	Low or no indoor loop flow	Delta T across the indoor loop ports should be 8-12°F (3-6°C), or compare pressure drop to the tables for the unit.	Increase flow rate if new installation, check for fouled heat exchanger if existing installation.
	Temperature setpoint(s) too high (if using BACnet or Signals control)	Use PC APP to verify that Indoor OUT does not exceed 130°F (54°C) for W-series or 160°F (71°C) for WH-series.	Reduce setpoint(s).
	EEV stuck almost closed or partially blocked by foreign object	Manually adjusting the EEV does not affect the superheat or the suction pressure. High superheat and low suction pressure.	Go to EEV troubleshooting section.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.
	Unit is overcharged (after servicing)	High subcooling, low indoor loop delta T.	Remove 1/2 lb of refrigerant at a time and verify that the discharge pressure reduces. Or remove charge and weigh back in the amount listed on nameplate.
Low Suction Pressure	Indoor OUT temperature too cold (on startup or if unit has been off for extended period).	Ensure Indoor OUT temperature is above the low limit indicated in the **Model Specific Information** chapter.	Reduce flow temporarily until Indoor OUT temperature has risen sufficiently.
	Low or no outdoor loop flow	Delta T across the outdoor loop ports should be 5-7°F (3-4°C), or compare pressure drop to the tables for the unit.	Determine the cause of the flow restriction and correct it. Verify pumps are working and sized correctly for ground loop systems. Verify well pump and water valve is working for ground water systems.
	Entering liquid temperature too cold	Measure the entering liquid temperature. Most likely caused by undersized ground loop.	Increase the size of the ground loop.
	Dirty or fouled brazed plate heat exchanger. (typically for open loop, less likely for ground loop)	Disconnect the water lines and check the inside of the pipes for scale deposits.	Backflush the heat exchanger with a calcium-removing cleaning solution.
	TS1 (or TS2) temperature sensor not reading properly	If the sensor is reading low, the superheat will appear high, which causes the EEV to continually close.	Verify EEV position is low compared to normal. Check temperature sensor, replace if necessary.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.

go to TABLE OF CONTENTS

OPERATION TROUBLESHOOTING - HEATING MODE			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Low suction pressure (continued)	EEV stuck almost closed or partially blocked by foreign object	Manually adjusting the EEV does not affect the superheat or the suction pressure. High superheat and discharge pressure.	Go to EEV troubleshooting section.
	Low refrigerant charge	Superheat is high, EEV position is high.	Locate the leak and repair it. Spray Nine, a sniffer, and/or dye are common methods of locating a leak.
High Suction Pressure (may appear to not be pumping)	EEV stuck open	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low superheat and discharge pressure.	Go to EEV troubleshooting section.
	Leaking reversing valve if present (can cause compressor to overheat and trip internal overload)	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot, low compressor discharge pressure.	Switch back and forth into cooling mode to try to free up valve. If it can't be freed, replace reversing valve.
	Faulty compressor, not pumping	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Compressor frosting up	See Low Suction Pressure in this section.		
EEV frosting up	EEV stuck almost closed or partially blocked by foreign object	Manually adjusting the EEV does not affect the superheat or the suction pressure. High superheat and discharge pressure.	Go to EEV troubleshooting section.
Random high pressure trip (may not occur while on site)	Faulty indoor circulator relay	Using the PC APP, manually turn the ICR on/off several times and ensure the circulator(s) start and stop.	Replace relay.
Random manual high pressure trip (may not occur while on site)	Faulty compressor contactor	Points pitted or burned. Contactor sometimes sticks causing the compressor to run when it should be off.	Replace contactor.

go to TABLE OF CONTENTS

OPERATION TROUBLESHOOTING - COOLING MODE (HAC models only)			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
Heating instead of cooling	Zone thermostat interconnection or external control system not set up properly	Verify that there is 24VAC across O and C/CA of the aquastat strip on control board when cooling should be active.	Correct thermostat or external control system setup.
	Faulty reversing valve solenoid coil or motorized actuator	Verify solenoid by removing it from the shaft while the unit is running. There should be a loud “whoosh” sound when it is removed. Or for motorized actuator, verify shaft rotates 90° when changing modes.	Replace solenoid or motorized actuator if faulty.
	Faulty or stuck reversing valve	A click can be heard when the coil is energized but the unit continues to heat instead of cool, or shaft will not turn.	Replace reversing valve.
High discharge pressure	Low or no outdoor loop flow	Delta T across the outdoor loop ports should be 8-12°F (4-7°C), or compare pressure drop to the tables for the unit.	Determine the cause of the flow restriction and correct it. Verify pumps are working for ground loop systems. Verify well pump and water valve is working for ground water systems.
	Outdoor loop entering liquid temperature too warm	Measure the entering liquid temperature. Most likely caused by undersized ground loop.	Verify the ground loop sizing. Increase the size of the ground loop if undersized.
	Dirty or fouled outdoor loop brazed plate heat exchanger. (typically for open loop, less likely for ground loop)	Disconnect the water lines and check the inside of the pipes for scale deposits.	Backflush the heat exchanger with a calcium-removing cleaning solution.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-dryer.
	Unit is overcharged (after servicing)	High subcooling.	Remove 1/2 lb of refrigerant at a time and verify that the discharge pressure reduces. Or remove charge and weigh back in the amount listed on nameplate.

go to TABLE OF CONTENTS

OPERATION TROUBLESHOOTING - COOLING MODE (HAC models only)			
Fault	**Possible Cause**	**Verification**	**Recommended Action**
High suction pressure (may appear to not be pumping)	EEV stuck open	Manually adjusting the EEV does not affect the superheat or the suction pressure. Low super heat and discharge pressure.	Go to EEV troubleshooting section.
	Leaking reversing valve (can cause compressor to overheat and trip internal overload)	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot, low compressor discharge pressure.	Switch back and forth into cooling mode to try to free up valve. If it can't be freed, replace reversing valve.
	Faulty compressor, not pumping	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Low suction pressure	Low indoor loop liquid flow	Check for high delta T with the PC APP. The EEV will be at a lower position than normal as well.	Verify pump is working and sized correctly. Check for restrictions in the circuit, e.g. valve partially closed.
	Temperature setpoint(s) too low (if using BACnet or Signals control)	Use PC APP to verify that Indoor OUT is not less than the minimums listed in the **Model Specific Information** chapter.	Reduce setpoint(s).
	EEV stuck almost closed or partially blocked by foreign object	Manually adjusting the EEV does not affect the superheat or the suction pressure. High superheat and high discharge pressure.	Go to EEV troubleshooting section.
	TS1 (or TS2) temperature sensor not reading properly	If the sensor is reading low it will cause the superheat to appear high, which causes the EEV to continually close.	Verify EEV position is low compared to normal. Check temperature sensor, replace if necessary.
	Filter-dryer plugged	Feel each end of the filter-dryer; they should be the same temperature. If there is a temperature difference then it is plugged. Also causes high discharge pressure.	Replace filter-dryer.
	Low refrigerant charge	Indoor loop EWT and flow are good but suction is low. Check static refrigeration pressure of unit for a low value. Weigh out charge to verify amount.	Locate the leak and repair it. Spray Nine, a sniffer, and dye are common methods of locating a leak.
Compressor frosting up	See Low Suction Pressure in this section		
EEV frosting up	EEV stuck almost closed or partially blocked by foreign object	Manually adjusting the EEV does not affect the superheat or the suction pressure. High superheat and discharge pressure.	Go to EEV troubleshooting section.
Random manual high pressure trip (may not occur while on site)	Faulty compressor contactor	Points pitted or burned. Contactor sometimes sticks causing the compressor to run when it should be off.	Replace contactor.

go to TABLE OF CONTENTS

EEV (Electronic Expansion Valve) TROUBLESHOOTING

Electronic expansion valves are a great advancement over TVX's, allowing more precise refrigerant control, but they do have a couple of limitations.

a) EEV's receive commands to open or close from the control board, but they don't send any feedback to the control board to confirm that command has been received and acted upon. If they aren't reliably acted upon (due to pulses missed due to a wiring issue or EEV being mechanically stuck), the actual valve opening position won't match what the control board thinks it is. In extreme cases, the resulting repeated commands can cause the *apparent* valve position to go to **15%** (minimum) or **100%**, when the valve is actually in between.

b) A restriction in the refrigeration circuit (particularly the liquid line, e.g. plugged filter-dryer) or shortage of refrigerant due to a leak can cause a similar issue. If the EEV opens to allow more refrigerant flow to lower the superheat but liquid refrigerant is not available at its inlet, the EEV will continue to open to attempt to let more refrigerant through and will work its way towards **100%** (full open). **High superheat** is also a symptom.

If there is low suction pressure and the EEV position is also low then the problem is generally not in the refrigeration system; check the water or airflow of the indoor or outdoor loop, whichever is currently the cold side (evaporator).

Tests to determine if an EEV is working

- Sound test: turn the power to the heat pump off and back on again. Or manually set the EEV to 25% and wait for it to stop, then set the EEV to "–1%". Both actions will cause the EEV to overdrive closed. You should hear the valve clicking and then the clicking should change and get louder when the valve reaches 0%. If there is no sound, then it is likely that the EEV is faulty or stuck.
- Using the PC APP, put the system in manual override mode. Manually adjust the EEV position by at least 25% either up or down and check to see that the suction pressure, discharge pressure and superheat react to the change. If there is no reaction, then it is likely that the EEV is faulty or stuck.
- Set the EEV back to AUTO and then turn the heating or cooling demand off (but leave power on). Once the demand is off, if the EEV is working then the discharge pressure should remain significantly higher than the suction pressure, i.e. the system will not equalize (since EEV's are closed when there is no demand). If the system does equalize it is likely that the EEV is not working and is partially open.

There are 3 possible causes for EEV problems: the control board is not working properly, the wire/cable is faulty, or the EEV is faulty.

The EEV can be checked electrically:

- RED to GREEN 75ohms
- WHITE to BLACK 75ohms

If this test fails, EEV is bad and should be replaced, but if it passes it still may be mechanically defective.

Check with a new EEV:

A further check that can be performed is to connect a new EEV and cable to the control board and visually check the EEV so see if it opens and closes by setting the position to 0 and 100% If the new EEV works then the EEV in the unit or the cable needs to be replaced.

1) Connect a test EEV and test cable to the control board.
2) Set the EEV position to 0%.
3) Set the EEV position to 100% and then listen for clicking and watch to see if the pintle in the EEV moves open.
4) Set the EEV position to 0% and then listen for clicking and watch to see if the pintle in the EEV moves closed.
5) If the EEV does not move in one or both directions then the control board must be replaced.
6) If the test EEV moves in both directions then then either the cable or the EEV in the unit is faulty.
7) Disconnect the test EEV from the test cable and connect it to the cable in the unit.
8) Repeat steps 2 to 4.
9) If the test EEV moves in both directions then the EEV in the unit is faulty and must be replaced.
10) If the test EEV does not move in one or both directions then the cable must be replaced.

go to TABLE OF CONTENTS

Repair Procedures

Pumpdown Procedure

1. Place the unit in SERVICE mode via the PC App or LCD interface; this will open the EEVs and start the circulators (if circulators are controlled by the heat pump). **DO NOT** turn off electrical power at the breaker panel, since the brazed plate heat exchangers **must have full water flow** during refrigerant recovery.
2. Connect the refrigerant recovery unit to the heat pump's internal service ports via a refrigeration charging manifold and to a recovery tank as per the instructions in the recovery unit manual. Plan to dispose of refrigerant if there was a compressor burnout.
3. All refrigerant to water heat exchangers (brazed plates) **must either have full flow or be completely drained** of fluid before recovery begins. If necessary, start circulation pumps via building control system. Failure to do so can freeze and rupture the heat exchanger, voiding its warranty. (Note that this does not apply to desuperheater coils.)
4. Ensure all hose connections are properly purged of air. Start the refrigerant recovery as per the instructions in the recovery unit manual.
5. Allow the recovery unit suction pressure to reach a vacuum. Once achieved, close the charging manifold valves. Shut down, purge and disconnect the recovery unit as per the instructions in its manual. Ensure the recovery tank valve is closed before disconnecting the hose to it.
6. Connect a nitrogen tank to the charging manifold and add nitrogen to the heat pump until a positive gauge pressure of 5-10 psig is reached. This prevents air from being sucked into the unit by the vacuum when the hoses are disconnected.

Turn off power to heat pump. The heat pump is now ready for repairs.

General Repair Procedure

1. Perform repairs to system.
    - Always ensure nitrogen is flowing through the system at the lowest flow rate that can be felt at the discharge during any brazing procedures to prevent soot buildup inside the pipes.
    - It is recommended to replace the liquid line filter-dryer any time the refrigeration system has been exposed to the atmosphere.
    - Place a wet rag around any valves being installed, as almost all valve types have non-metallic seats or seals that will be damaged by excessive heat, and aim the torch flame away from the valve body. Solder only one joint at a time and cool joints down in between.
2. Pressure test the system with nitrogen. It is recommended to check for leaks using leak detection spray, Spray Nine, or soapy water. Check at 10, 25, 50 and 100 psig. Allow the system to sit at 100 psig for at least an hour, then re-check. With a laptop connected, the **PC App** may be used to graph the nitrogen pressure (**Graphs** menu--> **Refrigeration Pressure and Temperature Graphs**) to make any downward trend due to a leak apparent. Be aware that changing room temperature can also cause upward or downward trends in nitrogen pressure.

Vacuuming & Charging Procedure

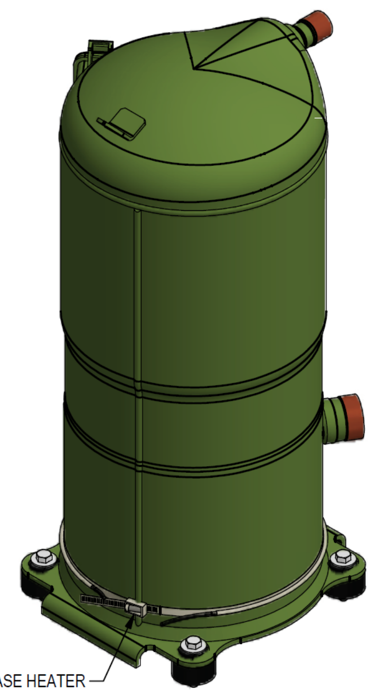
After completion of repairs and nitrogen pressure testing, the refrigeration circuit is ready for vacuuming.

1. Release the nitrogen pressure and connect the vacuum pump to the charging manifold. Start the vacuum pump and open the charging manifold valves. Vacuum until the vacuum gauge remains at less than 500 microns for at least 1 minute with the vacuum pump valve closed.
2. Close the charging manifold valves then shut off and disconnect the vacuum pump. Place a refrigerant tank with the proper refrigerant on a scale and connect it to the charging manifold. Purge the hose to the tank.
3. Weigh in the appropriate amount **and type** of refrigerant through the low pressure (suction) service port. Refer to the nameplate label on the unit for the proper refrigerant type and charge amount.
4. If the unit will not accept the entire charge, the remainder can be added through the low pressure service port after the unit has been restarted.

go to TABLE OF CONTENTS

Compressor Replacement Procedure

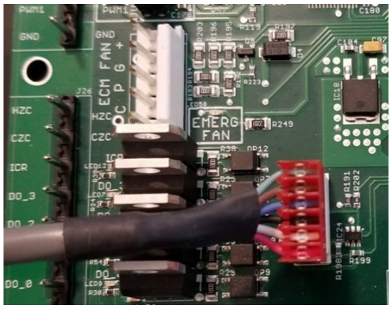
1. Pump down the unit as per the Pumpdown Procedure above. **If there was a compressor burn out (motor failure), the refrigerant cannot be reused and must be disposed of according to local codes**,
2. Disconnect piping. Remove crankcase heater, leaving electrically connected.
3. Replace the compressor. Replace the liquid line filter-dryer. Always ensure nitrogen is flowing through the system at the lowest flow rate that can be felt at the discharge during any brazing procedures to prevent soot buildup inside the pipes.
4. Vacuum the unit as per above procedure.
5. If there was a compressor burnout:
   - ***a)*** Charge the unit with **new** refrigerant and operate it for continuously for 2 hours. Pump down the unit and replace the filter-dryer. Vacuum the unit as per above procedure.
   - ***b)*** Charge the unit (refrigerant can be re-used) and operate it for 2-3 days. Perform an acid test. If it fails, pump down the unit and replace the filter-dryer.
   - ***c)*** Charge the unit (refrigerant can be re-used) and operate it for 2 weeks. Perform an acid test. If it fails, pump down the unit and replace the filter-dryer.
5. Charge the unit a final time. Unit should now be clean and repeated future burn-outs can be avoided.
6. Check crankcase heater to be sure it is operational and not shorted out. Procure a replacement if necessary. Install crankcase heater with worm screw over weld seam of compressor as shown.

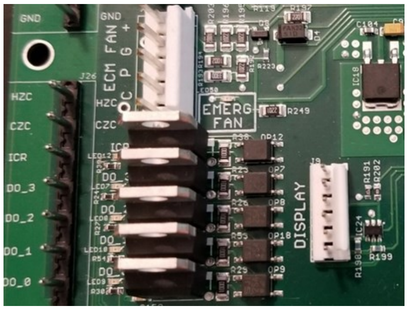


go to TABLE OF CONTENTS

Control Board Replacement Procedure

1. Turn the power off to the unit.
2. Take a picture of the control board and connectors for reference. The picture in **Appendix A** may also be helpful.
3. Carefully remove all green terminal strips on the left side, the right side and the bottom of the control board. They pull straight off the board, with no need to disconnect wires from their screw terminals. You may need to wiggle them from both ends for the 8 pin ones.
4. Remove the red six pin display board connector from the left side of the control board (marked DISPLAY on the board).





5. Remove all connectors from the top of the control board. Each connector (or wire) should be marked already from the factory, e.g. HPS1, LP1, TS1, etc.. This matches the marking on the control board.
6. The control board is held in place at its four corners. Squeeze each standoff by hand or with needle nose pliers if necessary and carefully pull the corner of the board off of the standoff.
7. Once the control board has been removed, if there are any other standoffs left (they have the bottom snap cut off) remove them as well.
8. Carefully remove the new control board from the static bag it was shipped in. Place any cut off standoffs from the old board into the same locations on the new board.
9. Align the control board with the four corner standoffs in the electrical box then push on each corner until they snap in place.
10. Connect the top connectors to the control board. Refer to the **Step 2** picture if necessary for proper locations.

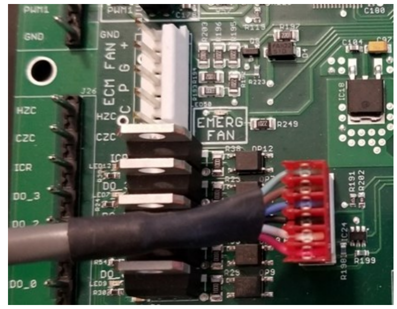
    Note that the connector with the resistor (no cable) goes on **CTS**.
    Note that the connector to the left of **CTS** is marked **HTS** on older boards, and **ODTS** on newer boards.

11. Check each of the connectors from Step 10 to ensure they are properly aligned and that no pins are showing.
12. Connect the green terminal strips to the left side, right side and bottom of the control board. Refer to the **Step 2** picture if necessary for locations.
13. Turn the power on to the heat pump. Ensure the LCD display comes on. Note the firmware version. After EEV zeroing and Random Start countdown the display should begin alternating data.
14. If the replacement control board was pre-configured for this unit at the factory then the system is ready for operation. If it was not then use the PC App corresponding to the unit's firmware version to configure the unit. Refer to the **Tools -> Configuration** menu in the **PC APP** chapter.

go to TABLE OF CONTENTS

LCD Interface (Display) Board Replacement Procedure

1. Turn the power off to the unit.
2. Remove the display board cable connector from the control board.



3. Using a sharp utility knife with a long blade, slice each of the display board standoff heads off, taking care to not damage the lexan cover.

4. Pull the display board from the unit.
5. Remove the display board cable connector from the back of the display board.
6. Place a new display board standoff into each of the four holes in the cabinet.
7. Remove the new display board from the static bag it was shipped in.
8. Connect one end of the display board cable to the back of the display board. Ensure the connector is properly aligned and that no pins are showing.
9. Place the display board in position and align the four standoffs into the four holes of the board.
10. Push on each corner of the board until each standoff snaps in place, while pushing on the front of the standoff to keep it from popping out of the cabinet hole.
11. Connect the other end of the display board cable to the control board, ensuring the connector is aligned properly and that no pins are showing.
12. Turn the power on to the unit and verify the display works.
13. Once the display begins to scroll data, test each of the buttons to ensure they work. Push the Arrow button to enter the Main Menu, then use the Up and Down to move through the list, then push the OK button to exit again. If any of the buttons seem hard to press, repeat Step 10 and then test the buttons again.

go to TABLE OF CONTENTS

Model Specific Information

Table 21 - Flow Rates & Volumes

MODEL	Nominal Size (60Hz)	Nominal Size (50Hz)	Recommended Liquid Flow (Outdoor & Indoor Loops) 100% CAPACITY (2 COMPRESSORS)		Recommended Liquid Flow 50% CAPACITY (1 COMPRESSOR)		Heat Pump's Indoor Loop Holdup Volume		Heat Pump's Outdoor Loop Holdup Volume	
	tons	tons	gpm(US)	*L/s*	gpm(US)	*L/s*	US gal	*L*	US gal	*L*
W/WH-150	12	10	36	*2.3*	18	*1.2*	1.90	*7.2*	1.90	*7.2*
W/WH-185	17	14	48	*3.0*	24	*1.5*	2.77	*10.5*	2.77	*10.5*
W/WH-240	20	17	60	*3.8*	30	*1.9*	3.10	*11.7*	3.10	*11.7*
W/WH-300	23	20	72	*4.5*	36	*2.3*	3.54	*13.4*	3.54	*13.4*
W/WH-400	30	28	100	*6.3*	50	*3.2*	4.52	*17.1*	4.52	*17.1*
W/WH-500	40	34	120	*7.6*	60	*3.8*	5.78	*21.9*	5.78	*21.9*
W/WH-600	50	42	150	*9.5*	75	*4.8*	6.87	*26.0*	6.87	*26.0*
W/WH-800	65	55	190	*12.0*	95	*6.0*	8.62	*32.6*	8.62	*32.6*
W-900	70	58	210	*13.2*	105	*6.6*	9.49	*35.9*	9.49	*35.9*
W-1000	81	68	225	*14.2*	113	*7.1*	10.6	*40.0*	10.6	*40.0*

Table 22 - Refrigerant Charge (Per Circuit)

MODEL	TYPE	lb	*kg*	OIL
W-150	R410a	5.5	*2.5*	POE
W-185	R410a	9.5	*4.3*	POE
W-240	R410a	10	*4.5*	PVE-BVC32
W-300	R410a	11	*5.0*	PVE-BVC32
W-400	R410a	13	*5.9*	PVE-BVC32
W-500	R410a	22	*10.0*	PVE-BVC32
W-600	R410a	25	*11.4*	PVE-BVC32
W-800	R410a	29	*13.2*	PVE-BVC32
W-900	R410a	30	*13.6*	PVE-BVC32
W-1000	R410a	34	*15.5*	PVE-BVC32
WH-150	R134a	5.5	*2.5*	POE
WH-185	R134a	9.5	*4.3*	POE
WH-240	R134a	10	*4.5*	POE
WH-300	R134a	11	*5.0*	POE
WH-400	R134a	13	*5.9*	POE
WH-500	R134a	22	*10.0*	POE
WH-600	R134a	25	*11.4*	POE
WH-800	R134a	29	*13.2*	POE

- Oil capacity is marked on the compressor label.
- Refrigerant charge is **subject to revision; actual charge is indicated on the unit nameplate.**

Table 23 - Shipping Information

MODEL	WEIGHT lb (kg)	DIMENSIONS in (cm) L	W	H
W/WH-150	950 (432)	78 (198)	32 (81)	82 (208)
W/WH-185	1207 (549)	78 (198)	32 (81)	82 (208)
W/WH-240	1351 (614)	78 (198)	32 (81)	82 (208)
W/WH-300	1386 (630)	78 (198)	32 (81)	82 (208)
W/WH-400	1440 (655)	78 (198)	32 (81)	82 (208)
W/WH-500	1955 (889)	89 (226)	36 (91)	88 (224)
W/WH-600	2054 (934)	89 (226)	36 (91)	88 (224)
W/WH-800	2192 (996)	89 (226)	36 (91)	88 (224)
W-900	2340 (1064)	89 (226)	36 (91)	88 (224)
W-1000	2488 (1131)	89 (226)	36 (91)	88 (224)

go to TABLE OF CONTENTS

Table 24a - W-SERIES Operating Temperature Limits

Loop	Mode	Parameter	(°F)	(°C)	Note
Indoor Loop	**HEATING** (indoor is hot loop)	Minimum ELT/EWT	50	*10*	0-10VDC modulating water valve required on indoor loop at temperatures < 80°F (27°C), or manual flow reduction at startup
		Maximum LLT/LWT	130	*54*	
	ICE production	Maximum LLT/LWT	110	*43*	Maximum hot loop temperature during ICE production (specify ICE duty at order).
	COOLING (reversing HAC units only, indoor is cold loop)	Minimum LWT	40	*4*	Indoor loop with water only (no antifreeze).
		Minimum LLT	-->	-->	Indoor loop with antifreeze: depends on antifreeze type & %
		Maximum ELT	80	*27*	0-10VDC modulating water valve required on indoor loop above this temperature, or manual flow reduction at startup *(contact Engineering for firmware revision of this feature)*
Outdoor Loop	**HEATING** (outdoor is cold loop)	Minimum LWT	37	*3*	For water loops without antifreeze, e.g. open loop systems
		Maximum ELT/EWT	80	*27*	0-10VDC modulating water valve required on outdoor loop above this temperature to limit suction pressure *(contact Engineering for firmware revision of this feature)*
		Minimum LLT	-->	-->	Ground loop system: depends on antifreeze type and % settings.
	ICE production	Minimum LLT	0	*-17*	Minimum cold loop temperature during ice production (specify ICE duty at order).
	COOLING (reversing HAC units only, outdoor is hot loop)	Minimum ELT/EWT	50	*10*	0-10VDC modulating water valve required on outdoor loop at temperatures < 80°F (27°C) to keep head pressure up
		Maximum LLT/LWT	130	*54*	

ELT: Entering Liquid Temperature (implies antifreeze present)
LLT: Leaving Liquid Temperature (implies antifreeze present)
EWT: Entering Water Temperature
LWT: Leaving Water Temperature

Values in these tables are for rated liquid and water flows.

Table 24b - WH-SERIES Operating Temperature Limits

Loop	Mode	Parameter	(°F)	(°C)	Note
Indoor Loop	**HEATING** (indoor is hot loop)	Minimum EWT	70 - 110	*21 - 43*	Use formula (Outdoor EWT + 20°F) or (Outdoor EWT + 11°C). Lower temperatures require 0-10VDC modulating water valve, or manual flow reduction at startup.
		Maximum LWT	160	*71*	
	COOLING (reversing HAC units only, indoor is cold loop)	Minimum EWT	45	*7*	Indoor loop with water only (no antifreeze).
		Maximum ELT	90	*32*	0-10VDC modulating water valve required on indoor loop above this temperature, or manual flow reduction at startup *(contact Engineering for firmware revision of this feature)*
Outdoor Loop	**HEATING** (outdoor is cold loop)	Minimum EWT	45	*7*	
		Maximum ELT	90	*32*	0-10VDC modulating water valve required on outdoor loop above this temperature to limit suction pressure *(contact Engineering for firmware revision of this feature)*
	COOLING (reversing HAC units only, outdoor is hot loop)	Minimum EWT	70 - 110	*21 - 43*	Use formula (Outdoor EWT + 20°F) or (Outdoor EWT + 11°C). Lower temperatures require 0-10VDC modulating water valve.
		Maximum LLT/LWT	160	*71*	

EWT: Entering Water Temperature
LWT: Leaving Water Temperature

Values in these tables are for rated liquid and water flows.

go to TABLE OF CONTENTS

Table 25: Loop Pressure Drop Data			INDOOR (water 130°F)		INDOOR (water 104°F)		OUTDOOR (water 50°F)		OUTDOOR (15% methanol 32°F)		OUTDOOR (35% prop.glycol 32°F)	
	gpm	L/s	psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa
W/WH-150	24	1.5	0.9	6.2	0.9	6.2	1.0	6.9	1.1	7.6	1.2	8.3
	28	1.8	1.2	8.3	1.2	8.3	1.3	9.0	1.4	9.7	1.7	12
	32	2.0	1.5	10	1.5	10	1.6	11	1.8	12	2.2	15
	36	2.3	1.8	12	1.9	13	2.0	14	2.2	15	2.7	19
	40	2.5	2.2	15	2.3	16	2.4	17	2.6	18	3.2	22
	48	3.0	3.2	22	3.3	23	3.4	23	3.6	25		
W/WH-185	32	2.0	1.0	6.9	1.0	6.9	1.1	7.6	1.2	8.3	2.0	14
	36	2.3	1.2	8.3	1.3	9.0	1.4	9.7	1.6	11	2.2	15
	40	2.5	1.5	10	1.6	11	1.7	12	1.9	13	2.4	17
	48	3.0	2.1	15	2.2	15	2.3	16	2.5	17	2.9	20
	60	3.8	3.3	23	3.4	23	3.5	24	3.6	25	3.7	26
W/WH-240	32	2.0	0.8	5.5	0.8	5.5	0.9	6.2	1.0	6.9	1.7	12
	36	2.3	1.0	6.9	1.0	6.9	1.1	7.6	1.2	8.3	2.0	14
	40	2.5	1.2	8.3	1.2	8.3	1.3	9.0	1.5	10	2.2	15
	48	3.0	1.6	11	1.7	12	1.8	12	2.0	14	2.5	17
	60	3.8	2.5	17	2.6	18	2.7	19	2.9	20	3.3	23
	72	4.5	3.5	24	3.7	26	3.8	26	4.0	28	4.1	28
W/WH-300	36	2.3	0.7	4.8	0.7	4.8	0.8	5.5	0.9	6.2		
	40	2.5	0.9	6.2	0.9	6.2	1.0	6.9	1.1	7.6	2.1	15
	48	3.0	1.2	8.3	1.2	8.3	1.3	9.0	1.4	9.7	2.5	17
	60	3.8	1.7	12	1.8	12	1.9	13	2.1	15	3.1	21
	72	4.5	2.5	17	2.6	18	2.7	19	2.9	20	3.7	26
	90	5.7	3.9	27	4.0	28	4.1	28	4.4	30	4.8	33
W/WH-400	60	3.8	1.0	6.9	1.0	6.9	1.1	7.6	1.2	8.3	1.9	13
	72	4.5	1.4	9.7	1.4	9.7	1.5	10	1.7	12	2.3	16
	90	5.7	2.1	15	2.2	15	2.3	16	2.5	17	3.1	21
	100	6.3	2.6	18	2.7	19	2.8	19	3.0	21	3.5	24
	110	6.9	3.1	21	3.2	22	3.3	23	3.6	25	4.0	28
	120	7.6	3.7	26	3.8	26	3.9	27	4.2	29	4.6	32
W/WH-500	50	3.2	0.8	5	0.8	5	0.8	6	1.0	7	1.3	9
	60	3.8	1.1	7	1.1	7	1.1	8	1.3	9	1.7	12
	70	4.4	1.4	10	1.4	10	1.5	10	1.6	11	2.2	15
	80	5.0	1.8	12	1.8	12	1.9	13	2.0	14	2.8	19
	90	5.7	2.2	15	2.2	15	2.4	16	2.5	17	3.4	23
	100	6.3	2.7	18	2.7	19	2.9	20	3.1	21	4.0	28
	110	6.9	3.2	22	3.2	22	3.4	24	3.7	25	4.7	33
	120	7.6	3.7	26	3.8	26	4.0	28	4.3	30	5.5	38
	130	8.2	4.4	30	4.4	31	4.7	32	5.0	35	6.3	44

go to TABLE OF CONTENTS

Table 25: (cont'd) Loop Pressure Drop Data

	gpm	L/s	INDOOR (water 130°F) psi	INDOOR (water 130°F) kPa	INDOOR (water 104°F) psi	INDOOR (water 104°F) kPa	OUTDOOR (water 50°F) psi	OUTDOOR (water 50°F) kPa	OUTDOOR (15% methanol 32°F) psi	OUTDOOR (15% methanol 32°F) kPa	OUTDOOR (35% prop.glycol 32°F) psi	OUTDOOR (35% prop.glycol 32°F) kPa
W/WH-600	60	3.8	0.8	5	0.8	5	0.8	6	1.0	7	1.3	9
	75	4.7	1.1	8	1.2	8	1.2	8	1.4	10	1.8	13
	90	5.7	1.6	11	1.6	11	1.7	12	1.8	12	2.5	17
	110	6.9	2.3	16	2.3	16	2.4	17	2.6	18	3.5	24
	130	8.2	3.1	21	3.2	22	3.3	23	3.6	25	4.6	32
	150	9.5	4.1	28	4.2	29	4.4	30	4.7	32	5.9	40
	170	10.7	5.1	35	5.3	36	5.5	38	5.9	41	7.3	50
W/WH-800	80	5.0	0.9	6	0.9	6	0.9	6	1.1	8	1.4	10
	95	6.0	1.2	8	1.2	8	1.3	9	1.4	10	1.8	13
	110	6.9	1.5	11	1.6	11	1.6	11	1.8	12	2.4	16
	130	8.2	2.1	14	2.1	15	2.2	15	2.4	17	3.2	22
	150	9.5	2.7	19	2.8	19	2.9	20	3.1	21	4.0	28
	170	10.7	3.5	24	3.5	24	3.7	25	3.9	27	5.0	34
	190	12.0	4.3	29	4.4	30	4.6	31	4.9	34	6.0	42
	210	13.2	5.2	36	5.3	36	5.5	38	5.9	41	7.2	49
W-900	90	5.7	0.9	6	1.0	7	1.0	7	1.2	8	1.5	10
	105	6.6	1.2	8	1.3	9	1.3	9	1.5	10	1.9	13
	130	8.2	1.8	12	1.8	13	1.9	13	2.1	14	2.7	19
	150	9.5	2.4	16	2.4	17	2.5	17	2.7	18	3.5	24
	170	10.7	3.0	20	3.0	21	3.2	22	3.4	23	4.3	29
	190	12.0	3.7	25	3.7	26	3.9	27	4.2	29	5.2	36
	210	13.2	4.4	31	4.5	31	4.7	33	5.0	35	6.2	42
	230	14.5	5.3	36	5.4	37	5.6	39	6.0	41	7.2	50
W-1000	100	6.3	1.0	7	1.0	7	1.0	7	1.2	8	1.5	10
	113	7.1	1.2	8	1.2	8	1.3	9	1.5	10	1.8	13
	120	7.6	1.3	9	1.4	9	1.4	10	1.6	11	2.0	14
	140	8.8	1.8	12	1.8	12	1.9	13	2.0	14	2.6	18
	160	10.1	2.3	16	2.3	16	2.4	17	2.6	18	3.3	23
	180	11.4	2.8	20	2.9	20	3.0	21	3.2	22	4.0	28
	200	12.6	3.5	24	3.5	25	3.7	26	3.9	27	4.8	34
	220	13.9	4.1	29	4.2	29	4.4	31	4.7	33	5.7	40
	225	14.2	4.3	30	4.4	31	4.6	32	4.9	34	5.9	41
	240	15.1	4.9	34	5.0	35	5.2	36	5.5	38	6.6	46

go to TABLE OF CONTENTS

Standard Capacity Ratings - W-Series

Note: There are no Standard Capacity Ratings for the WH-Series; see WH Performance Tables.

Table 26 - W-SERIES Standard Capacity Ratings

Standard Capacity Ratings - Ground Loop Heating* 60Hz
EWT 104°F (40°C), ELT 32°F (0°C)

Model	Nominal Size	Liquid Flow (Outdoor & Indoor)		Input Energy	Condenser Capacity		COP_H
	tons	gpm	*L/s*	Watts	Btu/hr	*kW*	W/W
W-150	**12**	36	*2.3*	10,067	**115,100**	***34***	**3.35**
W-185	**15**	48	*3.0*	13,308	**155,400**	***46***	**3.42**
W-240	**20**	60	*3.8*	16,790	**197,900**	***58***	**3.45**
W-300	**23**	72	*4.6*	18,650	**231,000**	***68***	**3.66**
W-400	**30**	100	*6.3*	24,915	**291,700**	***85***	**3.43**
W-500	**40**	120	*7.6*	36,400	**423,900**	***124***	**3.41**
W-600	**50**	150	*9.5*	41,150	**478,900**	***140***	**3.41**
W-800	**65**	190	*12.0*	52,910	**612,500**	***179***	**3.39**
W-900	**70**	210	*13.2*	57,600	**683,500**	***200***	**3.48**
W-1000	**81**	225	*14.2*	72,771	**808,900**	***237***	**3.26**

*** 35% Propylene Glycol by Volume Outdoor (Ground) Loop Fluid**

Standard Capacity Ratings - Ground Water Heating 60Hz
EWT 104°F (40°C), ELT 50°F (10°C)

Model	Nominal Size	Liquid Flow (Outdoor & Indoor)		Input Energy	Condenser Capacity		COP_H
	tons	gpm	*L/s*	Watts	Btu/hr	*kW*	W/W
W-150	**12**	36	*2.3*	10,386	**153,800**	***45***	**4.34**
W-185	**15**	48	*3.0*	13,871	**207,300**	***61***	**4.38**
W-240	**20**	60	*3.8*	17,625	**274,500**	***80***	**4.56**
W-300	**23**	72	*4.6*	19,360	**316,900**	***93***	**4.80**
W-400	**30**	100	*6.3*	25,970	**408,600**	***119***	**4.61**
W-500	**40**	120	*7.6*	36,465	**569,800**	***167***	**4.58**
W-600	**50**	150	*9.5*	42,630	**683,400**	***200***	**4.70**
W-800	**65**	190	*12.0*	54,885	**850,600**	***249***	**4.54**
W-900	**70**	210	*13.2*	59,500	**914,800**	***268***	**4.51**
W-1000	**81**	225	*14.2*	74,774	**1,076,100**	***315***	**4.22**

go to TABLE OF CONTENTS

Standard Capacity Ratings - W-Series

Note: There are no Standard Capacity Ratings for the WH-Series; see WH Performance Tables.

Table 26 - W-SERIES Standard Capacity Ratings

Standard Capacity Ratings - Ground Loop Cooling* — 60Hz
EWT 53.6°F (12°C), ELT 77°F (25°C)

Model	Nominal Size	Liquid Flow (Outdoor & Indoor)		Input Energy	Evaporator Capacity		COP_C	EER
	tons	gpm	L/s	Watts	Btu/hr	kW	W/W	Btu/hr/W
W-150	12	36	2.3	9,085	140,700	41	4.55	15.5
W-185	15	48	3.0	11,054	172,300	51	4.57	15.6
W-240	20	60	3.8	14,635	224,600	66	4.50	15.4
W-300	23	72	4.6	15,960	272,500	80	5.00	17.1
W-400	30	100	6.3	22,070	365,300	107	4.85	16.6
W-500	40	120	7.6	29,055	474,600	139	4.79	15.5
W-600	50	150	9.5	36,415	578,000	169	4.65	15.9
W-800	65	190	12.0	47,030	743,800	228	4.63	15.8
W-900	70	210	13.2	52,300	802,000	235	4.50	15.3
W-1000	81	225	14.2	58,812	900,300	264	4.49	15.3

* 35% Propylene Glycol by Volume Outdoor (Ground) Loop Fluid

Standard Capacity Ratings - Ground Water Cooling — 60Hz
EWT 53.6°F (12°C), ELT 59°F (15°C)

Model	Nominal Size	Liquid Flow (Outdoor & Indoor)		Input Energy	Evaporator Capacity		COP_C	EER
	tons	gpm	L/s	Watts	Btu/hr	kW	W/W	Btu/hr/W
W-150	12	36	2.3	7,242	156,300	46	6.33	21.6
W-185	15	48	3.0	8,711	188,800	55	6.36	21.7
W-240	20	60	3.8	11,890	253,900	74	6.26	21.4
W-300	23	72	4.6	13,330	297,700	87	6.54	22.3
W-400	30	100	6.3	18,190	393,000	115	6.33	21.6
W-500	40	120	7.6	23,005	493,500	144	6.28	21.4
W-600	50	150	9.5	29,055	620,000	182	6.25	21.3
W-800	65	190	12.0	37,335	796,400	233	6.25	21.3
W-900	70	210	13.2	41,600	872,500	256	6.15	21.0
W-1000	81	225	14.2	47,213	981,700	288	6.10	20.8

go to TABLE OF CONTENTS

Performance Tables - W-Series (Heating/Cooling)

*Compressor current is for 460-3-60.
Multiply by 2.2 for 208-3-60.
Multiply by 0.8 for 575-3-60.

W-150-H**-P-*D-PP

R410a, 60 Hz, 2 x ZP72KCE-TFD (460-3-60)

HEATING

EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
25	15	36	21	4.2	69,400	14.3	9,938		114	36	110	5.7	**102,800**	**3.03**
30	20	36	25	4.7	77,600	14.5	10,028		115	36	110	6.2	**111,300**	**3.25**
35	25	36	30	5.2	86,700	14.6	10,125		116	36	111	6.7	**120,800**	**3.50**
40	29	36	34	5.8	96,600	14.7	10,218	104	116	36	111	7.3	**131,000**	**3.76**
45	34	36	39	6.4	107,200	14.8	10,296		117	36	112	7.9	**141,900**	**4.04**
50	39	36	43	7.1	118,800	14.9	10,386		118	36	113	8.6	**153,800**	**4.34**
55	43	36	47	7.9	131,400	15.0	10,475		118	36	113	9.3	**166,700**	**4.66**
60	48	36	51	8.7	144,800	15.1	10,554		119	36	114	10.0	**180,400**	**5.01**
25	15	36	21	3.8	62,900	15.3	10,832	115	124	36		5.5	**99,400**	**2.69**
30	20	36	26	4.3	71,100	15.4	10,945	114	124	36		6.0	**108,000**	**2.89**
35	25	36	30	4.8	80,200	15.6	11,036	114	124	36		6.5	**117,400**	**3.12**
40	30	36	35	5.4	90,100	15.7	11,134	113	125	36	120	7.1	**127,600**	**3.36**
45	34	36	39	6.1	100,900	15.8	11,214	112	125	36		7.7	**138,700**	**3.62**
50	39	36	43	6.8	112,700	16.0	11,303	112	125	36		8.4	**150,800**	**3.91**
55	44	36	48	7.5	125,500	16.1	11,391	111	125	36		9.1	**163,900**	**4.22**
60	48	36	52	8.4	139,500	16.2	11,464	110	126	36		9.9	**178,200**	**4.56**

COOLING

EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	**EER**
	37	36	45	8.9	**159,800**	12.0	6,881	55	79	36	66	10.9	182,500	**23.2**
	37	36	45	8.6	**155,400**	12.6	7,332	60	84	36	71	10.8	179,600	**21.2**
	37	36	45	8.4	**151,200**	13.2	7,801	65	89	36	76	10.6	177,000	**19.4**
54	38	36	45	8.2	**146,800**	13.9	8,310	70	95	36	81	10.5	174,300	**17.7**
	38	36	46	7.9	**142,400**	14.5	8,852	75	100	36	85	10.3	171,800	**16.1**
	39	36	46	7.7	**138,100**	15.2	9,434	80	105	36	90	10.2	169,500	**14.6**
	39	36	46	7.4	**133,700**	16.0	10,044	85	110	36	95	10.0	167,200	**13.3**
	39	36	46	7.2	**129,000**	16.8	10,712	90	116	36	100	9.9	164,800	**12.0**

METRIC

HEATING (METRIC)

EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
-3.9	-9.3	2.3	-6.2	2.3	20.30	14.3	9,938		45.8	2.3	43.2	3.2	**30.13**	**3.03**
-1.1	-6.7	2.3	-3.7	2.6	22.70	14.5	10,028		46.1	2.3	43.4	3.4	**32.62**	**3.25**
1.7	-4.1	2.3	-1.2	2.9	25.40	14.6	10,125		46.5	2.3	43.7	3.7	**35.40**	**3.50**
4.4	-1.5	2.3	1.2	3.2	28.30	14.7	10,218	40	46.9	2.3	44.1	4.1	**38.39**	**3.76**
7.2	1.1	2.3	3.6	3.6	31.42	14.8	10,296		47.2	2.3	44.4	4.4	**41.59**	**4.04**
10.0	3.7	2.3	6.1	3.9	34.82	14.9	10,386		47.6	2.3	44.8	4.8	**45.07**	**4.34**
12.8	6.3	2.3	8.4	4.4	38.51	15.0	10,475		48.0	2.3	45.2	5.2	**48.85**	**4.66**
15.6	8.8	2.3	10.8	4.8	42.44	15.1	10,554		48.3	2.3	45.6	5.6	**52.87**	**5.01**
-3.9	-9.2	2.3	-6.0	2.1	18.40	15.3	10,832	45.8	51.0	2.3		3.1	**29.10**	**2.69**
-1.1	-6.6	2.3	-3.5	2.4	20.80	15.4	10,945	45.6	51.2	2.3		3.3	**31.65**	**2.89**
1.7	-4.0	2.3	-1.0	2.7	23.50	15.6	11,036	45.3	51.3	2.3		3.6	**34.41**	**3.12**
4.4	-1.4	2.3	1.4	3.0	26.40	15.7	11,134	44.9	51.4	2.3	49	3.9	**37.40**	**3.36**
7.2	1.2	2.3	3.8	3.4	29.57	15.8	11,214	44.6	51.6	2.3		4.3	**40.65**	**3.62**
10.0	3.8	2.3	6.2	3.8	33.03	16.0	11,303	44.2	51.7	2.3		4.7	**44.20**	**3.91**
12.8	6.4	2.3	8.6	4.2	36.78	16.1	11,391	43.8	51.9	2.3		5.1	**48.03**	**4.22**
15.6	9.1	2.3	10.9	4.7	40.88	16.2	11,464	43.4	52.0	2.3		5.5	**52.23**	**4.56**

COOLING (METRIC)

EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Cooling (kW)**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	Heat Rej. (kW)	**COP_C**
	2.5	2.3	7.4	4.6	**43.93**	12.0	6,881	**12.8**	26.0	2.3	18.5	5.7	50.14	**6.80**
	2.7	2.3	7.5	4.5	**42.82**	12.6	7,332	**15.6**	28.9	2.3	21.2	5.6	49.47	**6.21**
	2.9	2.3	7.6	4.4	**41.70**	13.2	7,801	**18.3**	31.8	2.3	23.9	5.6	48.80	**5.69**
12	3.2	2.3	7.7	4.3	**40.50**	13.9	8,310	**21.1**	34.8	2.3	26.5	5.4	48.06	**5.19**
	3.4	2.3	7.9	4.1	**39.24**	14.5	8,852	**23.9**	37.7	2.3	29.3	5.4	47.33	**4.72**
	3.7	2.3	8.0	4.0	**37.95**	15.2	9,434	**26.7**	40.7	2.3	32.0	5.3	46.57	**4.28**
	3.9	2.3	8.1	3.9	**36.66**	16.0	10,044	**29.4**	43.6	2.3	34.6	5.2	45.87	**3.87**
	4.1	2.3	8.3	3.7	**35.29**	16.8	10,712	**32.2**	46.5	2.3	37.3	5.1	45.13	**3.49**

go to TABLE OF CONTENTS

Performance Tables - W-Series (Heating/Cooling)

W-185-H**-P-*D-PP

*R410a, 60 Hz, 2 x ZP**91**KCE-TFD (460-3-60)*

*Compressor current is for 460-3-60.
Multiply by 2.2 for 208-3-60.
Multiply by 0.8 for 575-3-60.

	EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
HEATING	25	15	48	21	4.2	94,300	20.5	13,085	104	115	48	110	5.8	**138,200**	**3.10**
	30	20	48	25	4.8	105,700	20.7	13,244		115	48	110	6.3	**150,200**	**3.32**
	35	24	48	30	5.3	118,100	20.9	13,404		116	48	111	6.8	**163,200**	**3.57**
	40	29	48	34	5.9	131,400	21.1	13,562		116	48	111	7.4	**177,000**	**3.82**
	45	34	48	39	6.5	145,300	21.3	13,717		117	48	112	8.0	**191,400**	**4.09**
	50	38	48	43	7.2	160,600	21.5	13,871		117	48	113	8.6	**207,300**	**4.38**
	55	43	48	47	8.0	177,100	21.7	14,021		118	48	113	9.4	**224,300**	**4.69**
	60	48	48	51	8.7	194,400	21.8	14,164		118	48	114	10.1	**242,100**	**5.01**
	25	15	48	21	3.8	85,100	21.7	14,298	114	124	48	120	5.6	**133,200**	**2.73**
	30	20	48	26	4.4	96,900	22.0	14,460	114	124	48		6.1	**145,500**	**2.95**
	35	25	48	30	4.9	109,400	22.2	14,621	113	124	48		6.6	**158,600**	**3.18**
	40	29	48	35	5.5	122,600	22.4	14,797	113	125	48		7.2	**172,400**	**3.41**
	45	34	48	39	6.2	136,900	22.7	14,954	112	125	48		7.8	**187,300**	**3.67**
	50	39	48	43	6.8	152,200	22.9	15,107	112	125	48		8.5	**203,100**	**3.94**
	55	43	48	47	7.6	168,700	23.1	15,256	111	125	48		9.2	**220,100**	**4.23**
	60	48	48	52	8.4	186,400	23.2	15,401	110	125	48		9.9	**238,300**	**4.53**

	EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	**EER**
COOLING	54	36	48	46	8.0	**193,000**	17.1	8,257	55	78	48	65	9.9	220,000	**23.4**
		36	48	46	7.8	**187,800**	17.6	8,825	60	83	48	70	9.7	216,700	**21.3**
		37	48	46	7.6	**183,100**	18.2	9,419	65	88	48	75	9.6	214,100	**19.4**
		37	48	46	7.4	**178,500**	18.9	10,065	70	94	48	80	9.5	211,700	**17.7**
		38	48	46	7.3	**174,000**	19.6	10,756	75	99	48	84	9.4	209,500	**16.2**
		38	48	47	7.1	**169,700**	20.3	11,500	80	104	48	89	9.3	207,800	**14.8**
		39	48	47	6.9	**165,400**	21.1	12,286	85	109	48	94	9.3	206,100	**13.5**
		39	48	47	6.7	**160,900**	22.0	13,150	90	115	48	99	9.2	204,600	**12.2**

METRIC

	EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
HEATING (METRIC)	-3.9	-9.4	3.0	-6.2	2.3	27.60	20.5	13,085	40	45.8	3.0	43.2	3.2	**40.50**	**3.10**
	-1.1	-6.8	3.0	-3.8	2.7	30.98	20.7	13,244		46.1	3.0	43.5	3.5	**44.02**	**3.32**
	1.7	-4.2	3.0	-1.2	2.9	34.61	20.9	13,404		46.4	3.0	43.8	3.8	**47.83**	**3.57**
	4.4	-1.6	3.0	1.1	3.3	38.51	21.1	13,562		46.7	3.0	44.1	4.1	**51.87**	**3.82**
	7.2	0.9	3.0	3.6	3.6	42.58	21.3	13,717		46.9	3.0	44.4	4.4	**56.09**	**4.09**
	10.0	3.6	3.0	6.0	4.0	47.07	21.5	13,871		47.2	3.0	44.8	4.8	**60.75**	**4.38**
	12.8	6.2	3.0	8.4	4.4	51.90	21.7	14,021		47.5	3.0	45.2	5.2	**65.74**	**4.69**
	15.6	8.7	3.0	10.8	4.8	56.97	21.8	14,164		47.8	3.0	45.6	5.6	**70.95**	**5.01**
	-3.9	-9.3	3.0	-6.0	2.1	24.90	21.7	14,298	45.8	51.0	3.0	49	3.1	**39.04**	**2.73**
	-1.1	-6.7	3.0	-3.5	2.4	28.40	22.0	14,460	45.5	51.1	3.0		3.4	**42.64**	**2.95**
	1.7	-4.1	3.0	-1.0	2.7	32.06	22.2	14,621	45.2	51.2	3.0		3.7	**46.48**	**3.18**
	4.4	-1.5	3.0	1.3	3.1	35.93	22.4	14,797	44.9	51.4	3.0		4.0	**50.53**	**3.41**
	7.2	1.1	3.0	3.8	3.4	40.12	22.7	14,954	44.6	51.5	3.0		4.3	**54.89**	**3.67**
	10.0	3.7	3.0	6.2	3.8	44.61	22.9	15,107	44.2	51.6	3.0		4.7	**59.52**	**3.94**
	12.8	6.3	3.0	8.6	4.2	49.44	23.1	15,256	43.8	51.7	3.0		5.1	**64.50**	**4.23**
	15.6	8.9	3.0	10.9	4.7	54.63	23.2	15,401	43.4	51.8	3.0		5.5	**69.84**	**4.53**

	EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Cooling (kW)**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	Heat Rej. (kW)	**COP_C**
COOLING (METRIC)	12	2.1	3.0	7.6	4.4	**56.56**	17.1	8,257	**12.8**	25.4	3.0	18.3	5.5	64.48	**6.86**
		2.4	3.0	7.7	4.3	**55.04**	17.6	8,825	**15.6**	28.4	3.0	21.0	5.4	63.51	**6.24**
		2.7	3.0	7.8	4.2	**53.66**	18.2	9,419	**18.3**	31.3	3.0	23.6	5.3	62.75	**5.69**
		2.9	3.0	7.9	4.1	**52.31**	18.9	10,065	**21.1**	34.2	3.0	26.4	5.3	62.04	**5.19**
		3.2	3.0	7.9	4.1	**50.99**	19.6	10,756	**23.9**	37.2	3.0	29.1	5.2	61.40	**4.75**
		3.5	3.0	8.1	3.9	**49.73**	20.3	11,500	**26.7**	40.1	3.0	31.9	5.2	60.90	**4.34**
		3.8	3.0	8.2	3.8	**48.47**	21.1	12,286	**29.4**	43.0	3.0	34.6	5.2	60.40	**3.96**
		4.1	3.0	8.3	3.7	**47.16**	22.0	13,150	**32.2**	45.9	3.0	37.3	5.1	59.96	**3.58**

go to TABLE OF CONTENTS

Performance Tables - W-Series (Heating/Cooling)

W-240-H**-P-*D-PP

R410a, 60 Hz, 2 x GSD60120VAB (460-3-60)

*Compressor current is for 460-3-60.
Multiply by 2.2 for 208-3-60.
Multiply by 0.8 for 575-3-60.

	EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	COP_H
HEATING	25	15	60	20	4.6	128,000	22.9	16,946	104	116	60	110	6.2	**184,800**	**3.20**
	30	20	60	25	5.1	142,000	23.1	17,069		116	60	111	6.6	**199,300**	**3.42**
	35	24	60	29	5.7	157,600	23.2	17,192		117	60	111	7.2	**215,300**	**3.67**
	40	29	60	34	6.3	174,300	23.4	17,317		117	60	112	7.8	**232,400**	**3.93**
	45	34	60	38	6.9	191,800	23.6	17,468		118	60	112	8.4	**250,500**	**4.20**
	50	38	60	42	7.6	211,200	23.8	17,610		118	60	113	9.0	**270,400**	**4.50**
	55	43	60	47	8.4	232,100	24.0	17,767		119	60	114	9.7	**291,800**	**4.81**
	60	48	60	51	9.1	253,800	24.2	17,960		119	60	115	10.5	**314,200**	**5.13**
	25	15	60	21	4.2	116,500	24.8	18,469	114	125	60	120	6.0	**178,500**	**2.83**
	30	20	60	25	4.7	130,600	25.0	18,616	114	125	60		6.4	**193,100**	**3.04**
	35	24	60	30	5.3	146,000	25.2	18,740	113	125	60		7.0	**209,000**	**3.27**
	40	29	60	34	5.9	162,700	25.4	18,885	113	126	60		7.5	**226,200**	**3.51**
	45	34	60	39	6.5	180,900	25.6	19,016	112	126	60		8.2	**244,800**	**3.77**
	50	39	60	43	7.2	200,500	25.8	19,176	111	126	60		8.8	**265,000**	**4.05**
	55	43	60	47	8.0	221,700	26.0	19,351	110	126	60		9.6	**286,800**	**4.34**
	60	48	60	51	8.8	244,700	26.3	19,522	110	127	60		10.4	**310,400**	**4.66**

	EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	EER
COOLING	54	36	60	45	8.5	**254,500**	17.9	11,090	55	77	60	66	10.5	290,700	**22.9**
		37	60	45	8.3	**247,500**	18.6	11,704	60	82	60	70	10.3	285,800	**21.1**
		37	60	46	8.0	**240,700**	19.4	12,373	65	87	60	75	10.1	281,200	**19.5**
		37	60	46	7.8	**234,100**	20.3	13,102	70	92	60	80	10.0	277,100	**17.9**
		38	60	46	7.6	**227,400**	21.3	13,892	75	97	60	85	9.8	273,100	**16.4**
		38	60	46	7.4	**220,900**	22.3	14,751	80	102	60	90	9.7	269,600	**15.0**
		39	60	47	7.1	**214,300**	23.4	15,679	85	107	60	95	9.6	266,100	**13.7**
		39	60	47	6.9	**207,800**	24.7	16,682	90	112	60	100	9.5	263,100	**12.5**

METRIC

	EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	COP_H
HEATING (METRIC)	-3.9	-9.5	3.8	-6.5	2.6	37.51	22.9	16,946	40	46.4	3.8	43.4	3.4	**54.16**	**3.20**
	-1.1	-6.9	3.8	-3.9	2.8	41.62	23.1	17,069		46.7	3.8	43.7	3.7	**58.41**	**3.42**
	1.7	-4.3	3.8	-1.5	3.2	46.19	23.2	17,192		46.9	3.8	44.0	4.0	**63.10**	**3.67**
	4.4	-1.7	3.8	0.9	3.5	51.08	23.4	17,317		47.2	3.8	44.3	4.3	**68.11**	**3.93**
	7.2	0.8	3.8	3.4	3.8	56.21	23.6	17,468		47.6	3.8	44.7	4.7	**73.41**	**4.20**
	10.0	3.4	3.8	5.8	4.2	61.90	23.8	17,610		47.8	3.8	45.0	5.0	**79.25**	**4.50**
	12.8	6.1	3.8	8.1	4.7	68.02	24.0	17,767		48.1	3.8	45.4	5.4	**85.52**	**4.81**
	15.6	8.6	3.8	10.5	5.1	74.38	24.2	17,960		48.4	3.8	45.8	5.8	**92.08**	**5.13**
	-3.9	-9.4	3.8	-6.2	2.3	34.14	24.8	18,469	45.6	51.5	3.8	49	3.3	**52.31**	**2.83**
	-1.1	-6.8	3.8	-3.7	2.6	38.28	25.0	18,616	45.3	51.7	3.8		3.6	**56.59**	**3.04**
	1.7	-4.2	3.8	-1.2	2.9	42.79	25.2	18,740	45.0	51.8	3.8		3.9	**61.25**	**3.27**
	4.4	-1.6	3.8	1.1	3.3	47.68	25.4	18,885	44.7	51.9	3.8		4.2	**66.29**	**3.51**
	7.2	1.0	3.8	3.6	3.6	53.02	25.6	19,016	44.3	52.1	3.8		4.6	**71.74**	**3.77**
	10.0	3.6	3.8	6.0	4.0	58.76	25.8	19,176	44.0	52.2	3.8		4.9	**77.66**	**4.05**
	12.8	6.2	3.8	8.4	4.4	64.97	26.0	19,351	43.6	52.4	3.8		5.3	**84.05**	**4.34**
	15.6	8.8	3.8	10.7	4.9	71.71	26.3	19,522	43.1	52.5	3.8		5.8	**90.97**	**4.66**

	EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Cooling** (kW)	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	Heat Rej. (kW)	COP_C
COOLING (METRIC)	12	2.2	3.8	7.3	4.7	**74.59**	17.9	11,090	12.8	25.0	3.8	18.6	5.8	85.20	**6.71**
		2.5	3.8	7.4	4.6	**72.54**	18.6	11,704	15.6	27.8	3.8	21.3	5.7	83.76	**6.18**
		2.8	3.8	7.6	4.4	**70.54**	19.4	12,373	18.3	30.6	3.8	23.9	5.6	82.41	**5.71**
		3.0	3.8	7.7	4.3	**68.61**	20.3	13,102	21.1	33.3	3.8	26.7	5.6	81.21	**5.25**
		3.3	3.8	7.8	4.2	**66.64**	21.3	13,892	23.9	36.1	3.8	29.3	5.4	80.04	**4.81**
		3.6	3.8	7.9	4.1	**64.74**	22.3	14,751	26.7	38.9	3.8	32.1	5.4	79.01	**4.40**
		3.8	3.8	8.1	3.9	**62.81**	23.4	15,679	29.4	41.7	3.8	34.7	5.3	77.99	**4.02**
		4.1	3.8	8.2	3.8	**60.90**	24.7	16,682	32.2	44.4	3.8	37.5	5.3	77.11	**3.66**

go to TABLE OF CONTENTS

Performance Tables - W-Series (Heating/Cooling)

W-300-H**-P-*D-PP

R410a, 60 Hz, 2 x GSD60137VAB (460-3-60)

*Compressor current is for 460-3-60.
Multiply by 2.2 for 208-3-60.
Multiply by 0.8 for 575-3-60.

	EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
HEATING	25	15	72	21	4.2	141,600	25.3	18,660	104	115	72	110	5.7	**203,900**	**3.20**
	30	19	72	25	4.8	159,800	25.7	18,915		115	72	110	6.2	**223,000**	**3.46**
	35	24	72	30	5.4	179,700	26.0	19,171		116	72	111	6.8	**243,800**	**3.73**
	40	29	72	34	6.0	200,800	26.3	19,430		116	72	111	7.4	**265,800**	**4.01**
	45	34	72	38	6.7	224,300	26.7	19,725		117	72	112	8.1	**290,300**	**4.31**
	50	38	72	43	7.5	249,900	27.1	20,016		117	72	113	8.8	**316,900**	**4.64**
	55	43	72	47	8.3	277,700	27.6	20,331		118	72	114	9.6	**345,800**	**4.98**
	60	48	72	51	9.2	307,700	28.0	20,699		118	72	115	10.5	**377,100**	**5.34**
	25	15	72	21	3.9	129,400	27.4	20,324	115	124	72	120	5.5	**197,400**	**2.85**
	30	20	72	26	4.4	147,200	27.8	20,604	114	124	72		6.0	**216,200**	**3.08**
	35	24	72	30	5.0	166,800	28.2	20,881	113	124	72		6.6	**236,700**	**3.32**
	40	29	72	34	5.6	188,200	28.6	21,184	113	125	72		7.2	**259,200**	**3.59**
	45	34	72	39	6.3	211,800	29.0	21,473	112	125	72		7.9	**283,800**	**3.87**
	50	39	72	43	7.1	237,600	29.4	21,777	111	125	72		8.6	**310,600**	**4.18**
	55	44	72	47	8.0	265,700	29.8	22,103	111	125	72		9.4	**339,800**	**4.51**
	60	48	72	51	8.9	296,300	30.3	22,459	110	125	72		10.3	**371,700**	**4.85**

	EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	**EER**
COOLING	54	35	72	45	8.4	**303,900**	20.3	13,175	55	76	72	65	10.4	346,500	**23.1**
		36	72	45	8.2	**296,600**	21.2	13,811	60	82	72	70	10.2	341,400	**21.5**
		36	72	46	8.0	**289,500**	22.1	14,493	65	87	72	75	10.1	336,600	**20.0**
		37	72	46	7.9	**282,400**	23.1	15,250	70	92	72	80	10.0	332,100	**18.5**
		38	72	46	7.7	**275,300**	24.3	16,071	75	97	72	85	9.8	327,800	**17.1**
		38	72	46	7.5	**268,200**	25.5	16,961	80	103	72	90	9.7	323,800	**15.8**
		39	72	46	7.3	**261,200**	26.8	17,903	85	108	72	95	9.6	320,000	**14.6**
		39	72	47	7.1	**253,900**	28.3	18,937	90	113	72	100	9.5	316,200	**13.4**

METRIC

	EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
HEATING (METRIC)	-3.9	-9.7	4.5	-6.2	2.3	41.50	25.3	18,660	40	45.8	4.5	43.2	3.2	**59.76**	**3.20**
	-1.1	-7.1	4.5	-3.8	2.7	46.83	25.7	18,915		46.1	4.5	43.4	3.4	**65.35**	**3.46**
	1.7	-4.4	4.5	-1.3	3.0	52.66	26.0	19,171		46.4	4.5	43.8	3.8	**71.45**	**3.73**
	4.4	-1.8	4.5	1.1	3.3	58.85	26.3	19,430		46.7	4.5	44.1	4.1	**77.90**	**4.01**
	7.2	0.9	4.5	3.5	3.7	65.74	26.7	19,725		47.0	4.5	44.5	4.5	**85.08**	**4.31**
	10.0	3.6	4.5	5.8	4.2	73.24	27.1	20,016		47.3	4.5	44.9	4.9	**92.87**	**4.64**
	12.8	6.2	4.5	8.2	4.6	81.40	27.6	20,331		47.6	4.5	45.3	5.3	**101.3**	**4.98**
	15.6	8.9	4.5	10.5	5.1	90.20	28.0	20,699		47.9	4.5	45.8	5.8	**110.5**	**5.34**
	-3.9	-9.6	4.5	-6.1	2.2	37.92	27.4	20,324	45.8	51.0	4.5	49	3.1	**57.85**	**2.85**
	-1.1	-6.9	4.5	-3.5	2.4	43.14	27.8	20,604	45.6	51.1	4.5		3.3	**63.36**	**3.08**
	1.7	-4.3	4.5	-1.1	2.8	48.88	28.2	20,881	45.2	51.2	4.5		3.7	**69.37**	**3.32**
	4.4	-1.6	4.5	1.3	3.1	55.16	28.6	21,184	44.9	51.4	4.5		4.0	**75.96**	**3.59**
	7.2	1.1	4.5	3.7	3.5	62.07	29.0	21,473	44.5	51.5	4.5		4.4	**83.17**	**3.87**
	10.0	3.7	4.5	6.1	3.9	69.63	29.4	21,777	44.1	51.6	4.5		4.8	**91.03**	**4.18**
	12.8	6.4	4.5	8.4	4.4	77.87	29.8	22,103	43.7	51.7	4.5		5.2	**99.59**	**4.51**
	15.6	9.1	4.5	10.7	4.9	86.80	30.3	22,459	43.2	51.8	4.5		5.7	**108.9**	**4.85**

	EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Cooling (kW)**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	Heat Rej. (kW)	**COP_C**
COOLING (METRIC)	12	1.8	4.5	7.3	4.7	**89.06**	20.3	13,175	12.8	24.6	4.5	18.6	5.8	101.6	**6.77**
		2.1	4.5	7.4	4.6	**86.92**	21.2	13,811	15.6	27.6	4.5	21.3	5.7	100.1	**6.30**
		2.4	4.5	7.6	4.4	**84.84**	22.1	14,493	18.3	30.4	4.5	23.9	5.6	98.65	**5.86**
		2.7	4.5	7.6	4.4	**82.76**	23.1	15,250	21.1	33.4	4.5	26.7	5.6	97.33	**5.42**
		3.1	4.5	7.7	4.3	**80.68**	24.3	16,071	23.9	36.3	4.5	29.3	5.4	96.07	**5.01**
		3.3	4.5	7.8	4.2	**78.60**	25.5	16,961	26.7	39.3	4.5	32.1	5.4	94.90	**4.63**
		3.7	4.5	7.9	4.1	**76.55**	26.8	17,903	29.4	42.2	4.5	34.7	5.3	93.78	**4.28**
		3.9	4.5	8.1	3.9	**74.41**	28.3	18,937	32.2	45.1	4.5	37.5	5.3	92.67	**3.93**

go to TABLE OF CONTENTS

Performance Tables - W-Series (Heating/Cooling)

W-400-H**-P-*D-PP

R410a, 60 Hz, 2 x GSD60182VAB (460-3-60)

*Compressor current is for 460-3-60.
Multiply by 2.2 for 208-3-60.
Multiply by 0.8 for 575-3-60.

HEATING

EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
25	14	100	21	3.7	173,000	34.0	24,521	104	115	100	109	5.1	**254,900**	**3.05**
30	19	100	26	4.3	198,000	34.4	24,818		116	100	110	5.6	**280,900**	**3.32**
35	24	100	30	4.9	224,900	34.7	25,084		116	100	110	6.2	**308,800**	**3.61**
40	29	100	35	5.5	254,100	35.1	25,380		117	100	111	6.8	**339,000**	**3.91**
45	34	100	39	6.2	286,900	35.4	25,659		117	100	112	7.5	**372,800**	**4.26**
50	39	100	43	6.9	321,600	35.8	25,976		118	100	112	8.2	**408,600**	**4.61**
55	43	100	47	7.8	359,300	36.3	26,309		119	100	113	9.0	**447,400**	**4.98**
60	48	100	51	8.7	401,400	36.7	26,640		119	100	114	9.8	**490,700**	**5.40**
25	15	100	22	3.4	157,100	36.7	26,773	115	124	100	120	4.9	**246,700**	**2.70**
30	20	100	26	3.9	181,700	37.1	27,064	115	125	100		5.5	**272,300**	**2.95**
35	24	100	31	4.5	208,200	37.4	27,349	114	125	100		6.0	**299,800**	**3.21**
40	29	100	35	5.1	237,900	37.9	27,672	114	125	100		6.6	**330,600**	**3.50**
45	34	100	39	5.8	269,800	38.3	27,965	113	125	100		7.3	**363,500**	**3.81**
50	39	100	43	6.6	305,600	38.7	28,276	112	126	100		8.0	**400,400**	**4.15**
55	44	100	48	7.4	344,700	39.1	28,604	111	126	100		8.8	**440,700**	**4.52**
60	49	100	52	8.3	386,400	39.6	28,948	110	126	100		9.7	**483,600**	**4.90**

COOLING

EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	**EER**
54	35	100	46	8.0	**398,600**	28.1	17,488	55	77	100	65	9.8	455,200	**22.8**
	36	100	46	7.8	**391,500**	29.2	18,388	60	82	100	70	9.7	451,200	**21.3**
	36	100	46	7.7	**384,300**	30.4	19,363	65	87	100	75	9.7	447,400	**19.8**
	37	100	46	7.5	**376,600**	31.7	20,453	70	93	100	80	9.6	443,400	**18.4**
	37	100	46	7.4	**368,600**	33.2	21,640	75	98	100	85	9.5	439,400	**17.0**
	38	100	46	7.2	**360,200**	34.8	22,931	80	103	100	89	9.4	435,500	**15.7**
	38	100	47	7.0	**351,700**	36.5	24,300	85	108	100	94	9.3	431,600	**14.5**
	39	100	47	6.9	**342,700**	38.3	25,802	90	114	100	99	9.2	427,800	**13.3**

METRIC

HEATING (METRIC)

EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
-3.9	-9.8	6.3	-6.0	2.1	50.70	34.0	24,521	40	46.2	6.3	42.8	2.8	**74.70**	**3.05**
-1.1	-7.1	6.3	-3.5	2.4	58.03	34.4	24,818		46.6	6.3	43.1	3.1	**82.32**	**3.32**
1.7	-4.4	6.3	-1.0	2.7	65.91	34.7	25,084		46.8	6.3	43.4	3.4	**90.50**	**3.61**
4.4	-1.7	6.3	1.3	3.1	74.47	35.1	25,380		47.2	6.3	43.8	3.8	**99.35**	**3.91**
7.2	1.0	6.3	3.8	3.4	84.10	35.4	25,659		47.4	6.3	44.2	4.2	**109.3**	**4.26**
10.0	3.7	6.3	6.2	3.8	94.30	35.8	25,976		47.8	6.3	44.6	4.6	**119.7**	**4.61**
12.8	6.3	6.3	8.5	4.3	105.3	36.3	26,309		48.1	6.3	45.0	5.0	**131.1**	**4.98**
15.6	9.1	6.3	10.8	4.8	117.6	36.7	26,640		48.4	6.3	45.4	5.4	**143.8**	**5.40**
-3.9	-9.7	6.3	-5.8	1.9	46.04	36.7	26,773	46.2	51.3	6.3	49	2.7	**72.30**	**2.70**
-1.1	-6.9	6.3	-3.3	2.2	53.25	37.1	27,064	45.8	51.4	6.3		3.1	**79.80**	**2.95**
1.7	-4.3	6.3	-0.8	2.5	61.02	37.4	27,349	45.6	51.6	6.3		3.3	**87.86**	**3.21**
4.4	-1.6	6.3	1.6	2.8	69.72	37.9	27,672	45.2	51.7	6.3		3.7	**96.89**	**3.50**
7.2	1.1	6.3	4.0	3.2	79.10	38.3	27,965	44.8	51.8	6.3		4.1	**106.5**	**3.81**
10.0	3.8	6.3	6.3	3.7	89.60	38.7	28,276	44.4	51.9	6.3		4.4	**117.3**	**4.15**
12.8	6.6	6.3	8.7	4.1	101.0	39.1	28,604	44.0	52.1	6.3		4.9	**129.2**	**4.52**
15.6	9.2	6.3	11.0	4.6	113.2	39.6	28,948	43.5	52.2	6.3		5.4	**141.7**	**4.90**

COOLING (METRIC)

EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Cooling (kW)**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	Heat Rej. (kW)	**COP_C**
12	1.9	6.3	7.6	4.4	**116.8**	28.1	17,488	12.8	24.9	6.3	18.2	5.4	133.4	**6.68**
	2.2	6.3	7.7	4.3	**114.7**	29.2	18,388	15.6	27.8	6.3	21.0	5.4	132.2	**6.24**
	2.4	6.3	7.7	4.3	**112.6**	30.4	19,363	18.3	30.7	6.3	23.7	5.4	131.1	**5.80**
	2.7	6.3	7.8	4.2	**110.4**	31.7	20,453	21.1	33.7	6.3	26.4	5.3	129.9	**5.39**
	3.0	6.3	7.9	4.1	**108.0**	33.2	21,640	23.9	36.6	6.3	29.2	5.3	128.8	**4.98**
	3.3	6.3	8.0	4.0	**105.6**	34.8	22,931	26.7	39.6	6.3	31.9	5.2	127.6	**4.60**
	3.6	6.3	8.1	3.9	**103.1**	36.5	24,300	29.4	42.4	6.3	34.6	5.2	126.5	**4.25**
	3.8	6.3	8.2	3.8	**100.4**	38.3	25,802	32.2	45.4	6.3	37.3	5.1	125.4	**3.90**

go to TABLE OF CONTENTS

Performance Tables - W-Series (Heating/Cooling)

W-500-H**-P-*D-PP

R410a, 60 Hz, 2 x GSD80235VWB (460-3-60)

*Compressor current is for 460-3-60. Multiply by 0.8 for 575-3-60.

	EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
HEATING	25	15	120	21	4.2	234,100	43.7	33,107	104	115	120	110	5.7	**343,700**	**3.04**
	30	20	120	25	4.8	265,400	44.2	33,399		116	120	110	6.3	**376,100**	**3.30**
	35	24	120	30	5.4	299,600	44.5	33,599		116	120	111	6.9	**411,000**	**3.58**
	40	29	120	34	6.0	336,300	44.8	33,804		117	120	112	7.5	**448,500**	**3.89**
	45	34	120	38	6.8	376,400	45.1	33,936		117	120	112	8.2	**489,200**	**4.22**
	50	39	120	43	7.5	419,400	45.3	34,094		118	120	113	8.9	**532,800**	**4.58**
	55	44	120	47	8.4	465,900	45.6	34,243		119	120	114	9.7	**579,900**	**4.96**
	60	48	120	51	9.3	516,500	45.8	34,347		119	120	115	10.5	**631,000**	**5.38**
	25	15	120	21	3.8	211,800	47.7	36,164	115	125	120	120	5.5	**331,800**	**2.69**
	30	20	120	26	4.4	243,500	48.1	36,447	114	125	120		6.1	**364,600**	**2.93**
	35	25	120	30	5.0	277,300	48.4	36,669	113	125	120		6.7	**399,200**	**3.19**
	40	29	120	34	5.6	313,800	48.8	36,893	113	125	120		7.3	**436,600**	**3.47**
	45	34	120	39	6.4	354,700	49.0	37,031	112	126	120		8.0	**478,000**	**3.78**
	50	39	120	43	7.2	398,300	49.2	37,139	111	126	120		8.7	**522,100**	**4.12**
	55	44	120	47	8.0	445,700	49.4	37,230	111	126	120		9.5	**569,900**	**4.49**
	60	49	120	51	9.0	498,300	49.6	37,314	110	126	120		10.4	**622,900**	**4.89**

	EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	**EER**
COOLING	54	36	120	45	8.5	**509,300**	35.0	22,394	55	77	120	65	10.4	580,400	**22.7**
		36	120	45	8.4	**500,900**	36.9	23,776	60	82	120	70	10.4	576,700	**21.1**
		37	120	45	8.2	**492,300**	38.9	25,235	65	88	120	75	10.3	573,100	**19.5**
		37	120	46	8.1	**484,300**	41.2	26,801	70	93	120	80	10.3	570,500	**18.1**
		38	120	46	7.9	**474,500**	43.7	28,525	75	98	120	85	10.2	566,600	**16.6**
		38	120	46	7.7	**464,400**	46.5	30,344	80	104	120	90	10.1	562,700	**15.3**
		39	120	46	7.6	**453,600**	49.6	32,304	85	109	120	95	10.0	558,600	**14.0**
		39	120	46	7.4	**442,500**	53.0	34,440	90	114	120	100	10.0	554,800	**12.8**

METRIC

	EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
HEATING (METRIC)	-3.9	-9.6	7.6	-6.2	2.3	68.60	43.7	33,107	40	46.2	7.6	43.2	3.2	**100.7**	**3.04**
	-1.1	-6.9	7.6	-3.8	2.7	77.80	44.2	33,399		46.6	7.6	43.5	3.5	**110.2**	**3.30**
	1.7	-4.3	7.6	-1.3	3.0	87.80	44.5	33,599		46.8	7.6	43.8	3.8	**120.5**	**3.58**
	4.4	-1.6	7.6	1.1	3.3	98.60	44.8	33,804		47.2	7.6	44.2	4.2	**131.4**	**3.89**
	7.2	1.1	7.6	3.4	3.8	110.3	45.1	33,936		47.4	7.6	44.6	4.6	**143.4**	**4.22**
	10.0	3.7	7.6	5.8	4.2	122.9	45.3	34,094		47.8	7.6	44.9	4.9	**156.1**	**4.58**
	12.8	6.4	7.6	8.1	4.7	136.5	45.6	34,243		48.1	7.6	45.4	5.4	**170.0**	**4.96**
	15.6	9.1	7.6	10.4	5.2	151.4	45.8	34,347		48.4	7.6	45.8	5.8	**184.9**	**5.38**
	-3.9	-9.6	7.6	-6.0	2.1	62.07	47.7	36,164	45.8	51.4	7.6	49	3.1	**97.24**	**2.69**
	-1.1	-6.8	7.6	-3.5	2.4	71.40	48.1	36,447	45.5	51.6	7.6		3.4	**106.9**	**2.93**
	1.7	-4.2	7.6	-1.1	2.8	81.30	48.4	36,669	45.2	51.7	7.6		3.7	**117.0**	**3.19**
	4.4	-1.5	7.6	1.3	3.1	92.00	48.8	36,893	44.8	51.8	7.6		4.1	**128.0**	**3.47**
	7.2	1.2	7.6	3.6	3.6	104.0	49.0	37,031	44.4	51.9	7.6		4.4	**140.1**	**3.78**
	10.0	3.9	7.6	6.0	4.0	116.7	49.2	37,139	44.1	52.1	7.6		4.8	**153.0**	**4.12**
	12.8	6.6	7.6	8.4	4.4	130.6	49.4	37,230	43.6	52.2	7.6		5.3	**167.0**	**4.49**
	15.6	9.3	7.6	10.6	5.0	146.0	49.6	37,314	43.1	52.3	7.6		5.8	**182.6**	**4.89**

	EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Cooling (kW)**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	Heat Rej. (kW)	**COP_C**
COOLING (METRIC)	12	2.0	7.6	7.3	4.7	**149.3**	35.0	22,394	12.8	24.9	7.6	18.6	5.8	170.1	**6.65**
		2.3	7.6	7.3	4.7	**146.8**	36.9	23,776	15.6	27.9	7.6	21.4	5.8	169.0	**6.18**
		2.6	7.6	7.4	4.6	**144.3**	38.9	25,235	18.3	30.9	7.6	24.0	5.7	168.0	**5.71**
		2.9	7.6	7.5	4.5	**141.9**	41.2	26,801	21.1	33.8	7.6	26.8	5.7	167.2	**5.30**
		3.2	7.6	7.6	4.4	**139.1**	43.7	28,525	23.9	36.8	7.6	29.6	5.7	166.1	**4.86**
		3.4	7.6	7.7	4.3	**136.1**	46.5	30,344	26.7	39.8	7.6	32.3	5.6	164.9	**4.48**
		3.7	7.6	7.8	4.2	**132.9**	49.6	32,304	29.4	42.7	7.6	35.0	5.6	163.7	**4.10**
		4.1	7.6	7.9	4.1	**129.7**	53.0	34,440	32.2	45.7	7.6	37.8	5.6	162.6	**3.75**

go to TABLE OF CONTENTS

Performance Tables - W-Series (Heating/Cooling)

W-600-H**-P-*D-PP

R410a, 60 Hz, 2 x GSD80295VWB (460-3-60)

*Compressor current is for 460-3-60. Multiply by 0.8 for 575-3-60.

HEATING

EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
25	15	150	21	4.2	295,100	54.2	41,766	104	115	150	110	5.8	**433,100**	**3.04**
30	20	150	25	4.8	334,200	54.5	41,998		116	150	110	6.3	**473,100**	**3.30**
35	25	150	30	5.4	375,700	54.8	42,149		116	150	111	6.9	**515,200**	**3.58**
40	29	150	34	6.0	420,200	55.1	42,336		117	150	112	7.5	**560,500**	**3.88**
45	34	150	38	6.8	469,600	55.3	42,439		117	150	112	8.1	**610,400**	**4.22**
50	39	150	43	7.5	521,200	55.6	42,586		118	150	113	8.8	**662,600**	**4.56**
55	44	150	47	8.3	576,800	55.8	42,712		119	150	114	9.6	**718,800**	**4.93**
60	49	150	51	9.2	638,500	55.9	42,756		119	150	114	10.4	**780,700**	**5.35**
25	15	150	21	3.9	267,700	59.1	45,618	114	125	150	120	5.6	**418,800**	**2.69**
30	20	150	26	4.4	306,500	59.4	45,845	114	125	150		6.1	**458,500**	**2.93**
35	25	150	30	5.0	347,500	59.8	46,043	113	125	150		6.7	**500,300**	**3.18**
40	30	150	34	5.7	393,300	60.0	46,150	113	125	150		7.3	**546,600**	**3.47**
45	34	150	39	6.4	441,500	60.2	46,294	112	126	150		7.9	**595,400**	**3.77**
50	39	150	43	7.1	494,900	60.5	46,412	111	126	150		8.7	**649,300**	**4.10**
55	44	150	47	8.0	552,600	60.7	46,506	111	126	150		9.4	**707,500**	**4.46**
60	49	150	51	8.8	613,800	60.8	46,578	110	127	150		10.3	**769,100**	**4.84**

COOLING

EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	**EER**
54	35	150	45	8.4	**628,500**	39.1	27,696	55	77	150	65	10.3	715,900	**22.7**
	36	150	45	8.2	**617,400**	41.7	29,489	60	82	150	70	10.2	710,900	**20.9**
	37	150	46	8.1	**606,100**	44.5	31,378	65	88	150	75	10.2	706,000	**19.3**
	37	150	46	7.9	**594,400**	47.6	33,375	70	93	150	80	10.1	701,100	**17.8**
	38	150	46	7.8	**583,400**	50.9	35,476	75	98	150	85	10.0	697,300	**16.4**
	39	150	46	7.6	**570,600**	54.6	37,718	80	103	150	90	10.0	692,100	**15.1**
	39	150	46	7.4	**557,200**	58.6	40,091	85	109	150	95	9.9	686,800	**13.9**
	40	150	46	7.2	**542,928**	63.0	42,614	90	114	150	100	9.8	681,103	**12.7**

METRIC

HEATING (METRIC)

EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
-3.9	-9.6	9.5	-6.2	2.3	86.50	54.2	41,766	40	46.2	9.5	43.2	3.2	**126.9**	**3.04**
-1.1	-6.8	9.5	-3.8	2.7	97.90	54.5	41,998		46.6	9.5	43.5	3.5	**138.7**	**3.30**
1.7	-4.2	9.5	-1.3	3.0	110.1	54.8	42,149		46.8	9.5	43.8	3.8	**151.0**	**3.58**
4.4	-1.5	9.5	1.1	3.3	123.1	55.1	42,336		47.2	9.5	44.2	4.2	**164.3**	**3.88**
7.2	1.2	9.5	3.4	3.8	137.6	55.3	42,439		47.4	9.5	44.5	4.5	**178.9**	**4.22**
10.0	3.9	9.5	5.8	4.2	152.7	55.6	42,586		47.8	9.5	44.9	4.9	**194.2**	**4.56**
12.8	6.6	9.5	8.2	4.6	169.0	55.8	42,712		48.1	9.5	45.3	5.3	**210.7**	**4.93**
15.6	9.3	9.5	10.5	5.1	187.1	55.9	42,756		48.4	9.5	45.8	5.8	**228.8**	**5.35**
-3.9	-9.4	9.5	-6.1	2.2	78.50	59.1	45,618	45.8	51.4	9.5	49	3.1	**122.7**	**2.69**
-1.1	-6.7	9.5	-3.5	2.4	89.80	59.4	45,845	45.5	51.6	9.5		3.4	**134.4**	**2.93**
1.7	-4.1	9.5	-1.1	2.8	101.8	59.8	46,043	45.2	51.7	9.5		3.7	**146.6**	**3.18**
4.4	-1.3	9.5	1.2	3.2	115.3	60.0	46,150	44.8	51.8	9.5		4.1	**160.2**	**3.47**
7.2	1.3	9.5	3.6	3.6	129.4	60.2	46,294	44.5	52.0	9.5		4.4	**174.5**	**3.77**
10.0	4.1	9.5	6.1	3.9	145.0	60.5	46,412	44.1	52.2	9.5		4.8	**190.3**	**4.10**
12.8	6.8	9.5	8.4	4.4	162.0	60.7	46,506	43.7	52.3	9.5		5.2	**207.3**	**4.46**
15.6	9.4	9.5	10.7	4.9	179.9	60.8	46,578	43.2	52.5	9.5		5.7	**225.4**	**4.84**

COOLING (METRIC)

EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Cooling (kW)**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	Heat Rej. (kW)	**COP_C**
12	1.9	9.5	7.3	4.7	**184.2**	39.1	27,696	12.8	24.9	9.5	18.5	5.7	209.8	**6.65**
	2.2	9.5	7.4	4.6	**180.9**	41.7	29,489	15.6	27.9	9.5	21.3	5.7	208.3	**6.13**
	2.6	9.5	7.5	4.5	**177.6**	44.5	31,378	18.3	30.8	9.5	24.0	5.7	206.9	**5.66**
	2.9	9.5	7.6	4.4	**174.2**	47.6	33,375	21.1	33.8	9.5	26.7	5.6	205.5	**5.22**
	3.3	9.5	7.7	4.3	**171.0**	50.9	35,476	23.9	36.7	9.5	29.5	5.6	204.4	**4.81**
	3.6	9.5	7.8	4.2	**167.2**	54.6	37,718	26.7	39.7	9.5	32.3	5.6	202.8	**4.43**
	3.9	9.5	7.9	4.1	**163.3**	58.6	40,091	29.4	42.6	9.5	34.9	5.5	201.3	**4.07**
	4.3	9.5	8.0	4.0	**159.1**	63.0	42,614	32.2	45.6	9.5	37.6	5.4	199.6	**3.72**

go to TABLE OF CONTENTS

Performance Tables - W-Series (Heating/Cooling)

W-800-H**-P-*D-PP

R410a, 60 Hz, 2 x GSD80385VWB (460-3-60)

*Compressor current is for 460-3-60. Multiply by 0.8 for 575-3-60.

HEATING

EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
25	15	190	21	4.2	371,700	69.9	52,973	104	115	190	110	5.8	**546,500**	**3.02**
30	20	190	25	4.8	422,100	70.6	53,484		115	190	110	6.3	**598,800**	**3.28**
35	25	190	30	5.4	477,000	71.2	53,866		116	190	111	6.9	**655,100**	**3.56**
40	29	190	34	6.1	534,800	71.8	54,275		116	190	112	7.5	**714,400**	**3.86**
45	34	190	38	6.8	599,200	72.3	54,570		117	190	112	8.2	**779,900**	**4.19**
50	39	190	42	7.6	668,600	72.8	54,909		118	190	113	9.0	**850,600**	**4.54**
55	44	190	47	8.4	743,500	73.3	55,226		118	190	114	9.8	**926,700**	**4.92**
60	49	190	51	9.4	825,200	73.7	55,452		119	190	115	10.6	**1,009,300**	**5.33**
25	15	190	21	3.8	337,600	76.0	57,711	114	124	190	120	5.6	**528,500**	**2.68**
30	20	190	26	4.4	387,500	76.8	58,215	114	124	190		6.1	**580,300**	**2.92**
35	25	190	30	5.0	441,500	77.5	58,725	113	125	190		6.7	**636,200**	**3.18**
40	30	190	34	5.7	500,800	78.1	59,088	113	125	190		7.3	**696,800**	**3.46**
45	35	190	39	6.4	564,800	78.7	59,476	112	125	190		8.0	**762,300**	**3.76**
50	39	190	43	7.2	635,100	79.1	59,732	111	125	190		8.8	**833,600**	**4.09**
55	44	190	47	8.1	711,500	79.5	59,947	110	126	190		9.6	**910,900**	**4.45**
60	49	190	51	9.0	793,900	80.0	60,217	110	126	190		10.5	**994,300**	**4.84**

COOLING

EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	**EER**
54	36	190	45	8.5	**806,465**	51.2	35,545	55	77	190	65	10.4	918,054	**22.7**
	36	190	45	8.4	**793,749**	54.6	37,878	60	83	190	70	10.4	913,326	**21.0**
	37	190	45	8.2	**780,351**	58.2	40,346	65	88	190	75	10.3	908,374	**19.3**
	38	190	46	8.1	**765,967**	62.2	42,994	70	93	190	80	10.3	903,047	**17.8**
	38	190	46	7.9	**750,220**	66.7	45,893	75	99	190	85	10.2	897,217	**16.3**
	39	190	46	7.7	**733,652**	71.6	48,943	80	104	190	90	10.1	891,083	**15.0**
	39	190	46	7.5	**715,907**	76.8	52,209	85	109	190	95	10.0	884,507	**13.7**
	40	190	46	7.3	**696,540**	82.7	55,772	90	115	190	100	10.0	877,321	**12.5**

METRIC

HEATING (METRIC)

EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
-3.9	-9.4	12.0	-6.2	2.3	108.9	69.9	52,973	40	45.9	12.0	43.2	3.2	**160.2**	**3.02**
-1.1	-6.7	12.0	-3.8	2.7	123.7	70.6	53,484		46.3	12.0	43.5	3.5	**175.5**	**3.28**
1.7	-4.1	12.0	-1.3	3.0	139.8	71.2	53,866		46.6	12.0	43.8	3.8	**192.0**	**3.56**
4.4	-1.4	12.0	1.0	3.4	156.7	71.8	54,275		46.9	12.0	44.2	4.2	**209.4**	**3.86**
7.2	1.2	12.0	3.4	3.8	175.6	72.3	54,570		47.2	12.0	44.6	4.6	**228.6**	**4.19**
10.0	3.9	12.0	5.8	4.2	195.9	72.8	54,909		47.5	12.0	45.0	5.0	**249.3**	**4.54**
12.8	6.6	12.0	8.1	4.7	217.9	73.3	55,226		47.8	12.0	45.4	5.4	**271.6**	**4.92**
15.6	9.2	12.0	10.4	5.2	241.8	73.7	55,452		48.1	12.0	45.9	5.9	**295.8**	**5.33**
-3.9	-9.3	12.0	-6.0	2.1	98.90	76.0	57,711	45.8	51.2	12.0	49	3.1	**154.9**	**2.68**
-1.1	-6.6	12.0	-3.5	2.4	113.6	76.8	58,215	45.5	51.3	12.0		3.4	**170.1**	**2.92**
1.7	-3.9	12.0	-1.1	2.8	129.4	77.5	58,725	45.2	51.4	12.0		3.7	**186.5**	**3.18**
4.4	-1.3	12.0	1.2	3.2	146.8	78.1	59,088	44.8	51.6	12.0		4.1	**204.2**	**3.46**
7.2	1.4	12.0	3.6	3.6	165.5	78.7	59,476	44.4	51.7	12.0		4.4	**223.4**	**3.76**
10.0	4.1	12.0	6.0	4.0	186.1	79.1	59,732	44.0	51.8	12.0		4.9	**244.3**	**4.09**
12.8	6.7	12.0	8.3	4.5	208.5	79.5	59,947	43.6	51.9	12.0		5.3	**267.0**	**4.45**
15.6	9.4	12.0	10.6	5.0	232.7	80.0	60,217	43.1	52.1	12.0		5.8	**291.4**	**4.84**

COOLING (METRIC)

EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Cooling (kW)**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	Heat Rej. (kW)	**COP_C**
12	2.1	12.0	7.3	4.7	**236.4**	51.2	35,545	12.8	25.2	12.0	18.6	5.8	269.1	**6.65**
	2.4	12.0	7.3	4.7	**232.6**	54.6	37,878	15.6	28.2	12.0	21.4	5.8	267.7	**6.15**
	2.7	12.0	7.4	4.6	**228.7**	58.2	40,346	18.3	31.1	12.0	24.0	5.7	266.2	**5.66**
	3.1	12.0	7.5	4.5	**224.5**	62.2	42,994	21.1	34.1	12.0	26.8	5.7	264.7	**5.22**
	3.4	12.0	7.6	4.4	**219.9**	66.7	45,893	23.9	37.1	12.0	29.6	5.7	262.9	**4.78**
	3.7	12.0	7.8	4.3	**215.0**	71.6	48,943	26.7	40.0	12.0	32.3	5.6	261.2	**4.40**
	4.0	12.0	7.8	4.2	**209.8**	76.8	52,209	29.4	42.9	12.0	35.0	5.6	259.2	**4.02**
	4.3	12.0	7.9	4.1	**204.1**	82.7	55,772	32.2	45.9	12.0	37.8	5.6	257.1	**3.66**

go to TABLE OF CONTENTS

Performance Tables - W-Series (Heating/Cooling)

W-900-H**-P-*D-PP

R410a, 60 Hz, 2 x GSD80421VWB (460-3-60)

*Compressor current is for 460-3-60. Multiply by 0.8 for 575-3-60.

HEATING

EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
25	15	210	21	4.2	411,300	78.9	57,759	104	115	210	110	5.7	**601,700**	**3.05**
30	20	210	25	4.8	462,300	79.5	58,181		115	210	110	6.2	**654,300**	**3.30**
35	25	210	30	5.3	518,600	80.0	58,503		116	210	111	6.8	**711,900**	**3.57**
40	29	210	34	5.9	578,300	80.6	58,877		116	210	111	7.4	**773,000**	**3.85**
45	34	210	38	6.6	645,400	81.1	59,139		117	210	112	8.0	**841,200**	**4.17**
50	39	210	43	7.4	717,800	81.6	59,446		118	210	113	8.7	**914,800**	**4.51**
55	44	210	47	8.2	796,500	82.1	59,713		118	210	114	9.5	**994,500**	**4.88**
60	48	210	51	9.1	882,200	82.4	59,854		119	210	114	10.3	**1,080,900**	**5.29**
25	15	210	21	3.8	374,200	85.1	62,835	115	124	210	120	5.5	**581,900**	**2.71**
30	20	210	26	4.4	424,700	85.8	63,308	114	124	210		6.0	**634,200**	**2.94**
35	25	210	30	4.9	480,200	86.5	63,745	113	125	210		6.6	**691,400**	**3.18**
40	30	210	34	5.6	541,600	87.1	64,057	113	125	210		7.2	**754,000**	**3.45**
45	34	210	39	6.3	608,500	87.7	64,409	112	125	210		7.8	**822,300**	**3.74**
50	39	210	43	7.0	681,500	88.2	64,714	112	125	210		8.5	**896,500**	**4.06**
55	44	210	47	7.8	761,200	88.7	64,966	111	126	210		9.3	**977,200**	**4.41**
60	49	210	51	8.7	847,800	89.1	65,162	110	126	210		10.1	**1,064,600**	**4.79**

COOLING

EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	**EER**
54	35	210	45	8.5	**886,800**	61.9	39,413	55	77	210	65	10.4	1,010,700	**22.5**
	36	210	45	8.3	**868,300**	65.3	41,875	60	82	210	70	10.3	1,000,500	**20.7**
	37	210	46	8.1	**849,300**	69.0	44,482	65	88	210	75	10.2	990,400	**19.1**
	37	210	46	7.9	**830,100**	73.0	47,250	70	93	210	80	10.1	980,600	**17.6**
	38	210	46	7.7	**810,500**	77.4	50,192	75	98	210	85	10.0	971,000	**16.1**
	38	210	46	7.5	**790,400**	82.2	53,322	80	104	210	90	9.9	961,500	**14.8**
	39	210	46	7.3	**768,200**	87.5	56,656	85	109	210	95	9.8	950,600	**13.6**
	40	210	47	7.1	**747,000**	93.3	60,199	90	114	210	100	9.7	941,500	**12.4**

METRIC

HEATING (METRIC)

EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
-3.9	-9.5	13.2	-6.2	2.3	120.5	78.9	57,759	40	45.9	13.2	43.2	3.2	**176.3**	**3.05**
-1.1	-6.8	13.2	-3.8	2.7	135.5	79.5	58,181		46.3	13.2	43.4	3.4	**191.8**	**3.30**
1.7	-4.2	13.2	-1.2	2.9	152.0	80.0	58,503		46.6	13.2	43.8	3.8	**208.6**	**3.57**
4.4	-1.6	13.2	1.1	3.3	169.5	80.6	58,877		46.9	13.2	44.1	4.1	**226.5**	**3.85**
7.2	1.1	13.2	3.5	3.7	189.1	81.1	59,139		47.2	13.2	44.4	4.4	**246.5**	**4.17**
10.0	3.8	13.2	5.9	4.1	210.4	81.6	59,446		47.5	13.2	44.8	4.8	**268.1**	**4.51**
12.8	6.4	13.2	8.2	4.6	233.4	82.1	59,713		47.8	13.2	45.3	5.3	**291.5**	**4.88**
15.6	9.1	13.2	10.5	5.1	258.5	82.4	59,854		48.1	13.2	45.7	5.7	**316.8**	**5.29**
-3.9	-9.4	13.2	-6.0	2.1	109.7	85.1	62,835	45.8	51.1	13.2	49	3.1	**170.5**	**2.71**
-1.1	-6.7	13.2	-3.5	2.4	124.5	85.8	63,308	45.6	51.3	13.2		3.3	**185.9**	**2.94**
1.7	-4.1	13.2	-1.0	2.7	140.7	86.5	63,745	45.2	51.4	13.2		3.7	**202.6**	**3.18**
4.4	-1.4	13.2	1.3	3.1	158.7	87.1	64,057	44.9	51.6	13.2		4.0	**221.0**	**3.45**
7.2	1.3	13.2	3.7	3.5	178.3	87.7	64,409	44.6	51.7	13.2		4.3	**241.0**	**3.74**
10.0	3.9	13.2	6.1	3.9	199.7	88.2	64,714	44.2	51.9	13.2		4.7	**262.7**	**4.06**
12.8	6.6	13.2	8.5	4.3	223.1	88.7	64,966	43.7	52.1	13.2		5.2	**286.4**	**4.41**
15.6	9.3	13.2	10.8	4.8	248.5	89.1	65,162	43.3	52.2	13.2		5.6	**312.0**	**4.79**

COOLING (METRIC)

EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Cooling (kW)**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	Heat Rej. (kW)	**COP_C**
12	1.9	13.2	7.3	4.7	**259.9**	61.9	39,413	12.8	25.0	13.2	18.6	5.8	296.2	**6.59**
	2.2	13.2	7.4	4.6	**254.5**	65.3	41,875	15.6	27.9	13.2	21.3	5.7	293.2	**6.07**
	2.6	13.2	7.5	4.5	**248.9**	69.0	44,482	18.3	30.9	13.2	24.0	5.7	290.3	**5.60**
	2.9	13.2	7.6	4.4	**243.3**	73.0	47,250	21.1	33.8	13.2	26.7	5.6	287.4	**5.16**
	3.2	13.2	7.7	4.3	**237.5**	77.4	50,192	23.9	36.8	13.2	29.5	5.6	284.6	**4.72**
	3.6	13.2	7.8	4.2	**231.6**	82.2	53,322	26.7	39.7	13.2	32.2	5.5	281.8	**4.34**
	3.8	13.2	7.9	4.1	**225.1**	87.5	56,656	29.4	42.7	13.2	34.8	5.4	278.6	**3.99**
	4.2	13.2	8.1	3.9	**218.9**	93.3	60,199	32.2	45.6	13.2	37.6	5.4	275.9	**3.63**

go to TABLE OF CONTENTS

Performance Tables - W-Series (Heating/Cooling)

W-1000-H**-P-*D-PP *R410a, 60 Hz, 2 x GSD80485 (460-3-60)*

*Compressor current is for 460-3-60. Multiply by 0.8 for 575-3-60.

HEATING

EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	COP$_H$
25	15	225	20	4.7	489,000	92.4	68,852	104	114	225	110	6.4	**717,200**	**3.05**
30	19	225	25	5.2	546,500	93.2	69,329		115	225	111	6.9	**776,400**	**3.28**
35	24	225	29	5.9	609,800	93.7	69,723		116	225	112	7.5	**841,200**	**3.54**
40	29	225	34	6.5	676,500	94.5	70,200		116	225	112	8.1	**909,700**	**3.80**
45	34	225	38	7.2	751,200	95.0	70,548		117	225	113	8.8	**985,700**	**4.09**
50	38	225	42	8.0	831,500	95.6	70,935		117	225	114	9.5	**1,067,400**	**4.41**
55	43	225	46	8.8	918,400	96.0	71,245		118	225	114	10.3	**1,155,500**	**4.75**
60	48	225	50	9.7	1,012,900	96.3	71,357		118	225	115	11.1	**1,250,500**	**5.14**
25	15	225	20.7	4.3	444,500	101.0	75,061	114	124	225	120	6.2	**693,900**	**2.71**
30	20	225	25.2	4.8	501,700	101.7	75,495	113	124	225		6.7	**752,700**	**2.92**
35	24	225	29.6	5.4	564,400	102.3	75,940	113	124	225		7.3	**817,000**	**3.15**
40	29	225	33.9	6.1	632,400	103.1	76,477	112	125	225		7.9	**887,000**	**3.40**
45	34	225	38.2	6.8	707,200	103.7	76,879	111	125	225		8.6	**963,300**	**3.67**
50	39	225	42.4	7.6	788,700	104.3	77,225	111	125	225		9.3	**1,046,100**	**3.97**
55	44	225	46.6	8.4	877,400	104.7	77,492	110	125	225		10.1	**1,135,800**	**4.30**
60	48	225	50.7	9.3	973,600	105.0	77,654	109	125	225		11.0	**1,232,700**	**4.65**

COOLING

EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	EER
54	36	225	45	8.9	**997,600**	63.8	44,994	55	77	225	66	10.9	1,139,900	**22.2**
	36	225	45	8.7	**975,600**	67.9	47,647	60	82	225	71	10.8	1,127,000	**20.5**
	37	225	45	8.5	**953,300**	72.4	50,499	65	88	225	76	10.7	1,114,500	**18.9**
	37	225	45	8.3	**931,300**	77.2	53,461	70	93	225	81	10.6	1,102,600	**17.4**
	38	225	46	8.1	**908,600**	82.5	56,658	75	98	225	86	10.5	1,090,900	**16.0**
	39	225	46	7.9	**884,200**	88.3	59,994	80	103	225	90	10.3	1,077,900	**14.7**
	39	225	46	7.7	**860,400**	94.7	63,595	85	109	225	95	10.2	1,066,400	**13.5**
	40	225	46	7.4	**836,600**	101.6	67,344	90	114	225	100	10.1	1,055,400	**12.4**

METRIC

HEATING (METRIC)

EVAPORATOR LOOP *(35% Propylene Glycol)*						ELECTRICAL		CONDENSER LOOP *(Water)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	COP$_H$
-3.9	-9.7	14.2	-6.5	2.6	143.3	92.4	68,852	40	45.8	14.2	43.6	3.6	**210.2**	**3.05**
-1.1	-7.1	14.2	-4.0	2.9	160.2	93.2	69,329		46.1	14.2	43.8	3.8	**227.5**	**3.28**
1.7	-4.4	14.2	-1.6	3.3	178.7	93.7	69,723		46.4	14.2	44.2	4.2	**246.5**	**3.54**
4.4	-1.8	14.2	0.8	3.6	198.3	94.5	70,200		46.7	14.2	44.5	4.5	**266.6**	**3.80**
7.2	0.9	14.2	3.2	4.0	220.2	95.0	70,548		47.0	14.2	44.9	4.9	**288.9**	**4.09**
10.0	3.6	14.2	5.6	4.4	243.7	95.6	70,935		47.3	14.2	45.3	5.3	**312.8**	**4.41**
12.8	6.2	14.2	7.9	4.9	269.2	96.0	71,245		47.7	14.2	45.7	5.7	**338.6**	**4.75**
15.6	8.9	14.2	10.2	5.4	296.9	96.3	71,357		47.9	14.2	46.2	6.2	**366.5**	**5.14**
-3.9	-9.6	14.2	-6.3	2.4	130.3	101.0	75,061	45.4	51.0	14.2	49	3.4	**203.4**	**2.71**
-1.1	-6.9	14.2	-3.8	2.7	147.0	101.7	75,495	45.2	51.1	14.2		3.7	**220.6**	**2.92**
1.7	-4.3	14.2	-1.3	3.0	165.4	102.3	75,940	44.8	51.2	14.2		4.1	**239.4**	**3.15**
4.4	-1.6	14.2	1.0	3.4	185.3	103.1	76,477	44.5	51.4	14.2		4.4	**260.0**	**3.40**
7.2	1.1	14.2	3.4	3.8	207.3	103.7	76,879	44.1	51.5	14.2		4.8	**282.3**	**3.67**
10.0	3.7	14.2	5.8	4.2	231.1	104.3	77,225	43.7	51.6	14.2		5.2	**306.6**	**3.97**
12.8	6.4	14.2	8.1	4.7	257.1	104.7	77,492	43.3	51.7	14.2		5.6	**332.9**	**4.30**
15.6	9.1	14.2	10.4	5.2	285.3	105.0	77,654	42.8	51.8	14.2		6.1	**361.3**	**4.65**

COOLING (METRIC)

EVAPORATOR LOOP *(Water)*						ELECTRICAL		CONDENSER LOOP *(35% Propylene Glycol)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Cooling (kW)**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	Heat Rej. (kW)	COP$_C$
12	2.0	14.2	7.1	4.9	**292.4**	63.8	44,994	12.8	25.1	14.2	18.9	6.1	334.1	**6.51**
	2.3	14.2	7.2	4.8	**285.9**	67.9	47,647	15.6	27.9	14.2	21.6	6.0	330.3	**6.01**
	2.7	14.2	7.3	4.7	**279.4**	72.4	50,499	18.3	30.9	14.2	24.2	5.9	326.6	**5.54**
	3.0	14.2	7.4	4.6	**272.9**	77.2	53,461	21.1	33.8	14.2	27.0	5.9	323.1	**5.10**
	3.3	14.2	7.5	4.5	**266.3**	82.5	56,658	23.9	36.7	14.2	29.7	5.8	319.7	**4.69**
	3.6	14.2	7.6	4.4	**259.1**	88.3	59,994	26.7	39.6	14.2	32.4	5.7	315.9	**4.31**
	3.9	14.2	7.7	4.3	**252.2**	94.7	63,595	29.4	42.6	14.2	35.1	5.7	312.5	**3.96**
	4.3	14.2	7.9	4.1	**245.2**	101.6	67,344	32.2	45.4	14.2	37.8	5.6	309.3	**3.63**

go to TABLE OF CONTENTS

Performance Tables - W-Series (Ice Making/Arena Application)

W-185-H**-P-*D-PP *R410a, 60 Hz, 2 x ZP91KCE-TFD (460-3-60)*

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Ice Cooling (Btu/hr)**	**EER**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
ICE	5	-3	48	2	3.2	**65,900**	**6.5**	16.3	10,118	85	94	48	89	4.1	**97,700**	**2.83**
	10	2	48	7	3.5	**73,700**	**7.2**	16.7	10,291		95	48	89	4.4	**106,400**	**3.03**
	15	6	48	11	3.9	**81,900**	**7.8**	17.1	10,470		95	48	90	4.8	**115,600**	**3.24**
	20	10	48	16	4.3	**90,700**	**8.5**	17.6	10,655		96	48	90	5.2	**125,400**	**3.45**
	25	15	48	20	4.8	**100,100**	**9.2**	18.0	10,832		96	48	91	5.7	**135,700**	**3.67**
	30	19	48	25	5.3	**110,100**	**10.0**	18.5	11,024		96	48	91	6.1	**146,700**	**3.90**
	35	24	48	29	5.8	**120,800**	**10.8**	18.9	11,220		97	48	92	6.6	**158,500**	**4.14**
	40	28	48	34	6.3	**132,200**	**11.6**	19.4	11,418		97	48	92	7.1	**170,900**	**4.39**

METRIC

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Ice Cooling (kW)**	**COP_C**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
ICE	-15.0	-19.4	3.0	-16.8	1.8	**19.3**	**1.91**	16.3	10,118	29.4	34.7	3.0	31.7	2.3	**28.6**	**2.83**
	-12.2	-16.9	3.0	-14.1	1.9	**21.6**	**2.10**	16.7	10,291		34.9	3.0	31.8	2.4	**31.2**	**3.03**
	-9.4	-14.5	3.0	-11.6	2.2	**24.0**	**2.29**	17.1	10,470		35.1	3.0	32.1	2.7	**33.9**	**3.24**
	-6.7	-12.1	3.0	-9.1	2.4	**26.6**	**2.49**	17.6	10,655		35.3	3.0	32.3	2.9	**36.8**	**3.45**
	-3.9	-9.6	3.0	-6.6	2.7	**29.3**	**2.71**	18.0	10,832		35.5	3.0	32.6	3.2	**39.8**	**3.67**
	-1.1	-7.2	3.0	-4.0	2.9	**32.3**	**2.93**	18.5	11,024		35.7	3.0	32.8	3.4	**43.0**	**3.90**
	1.7	-4.7	3.0	-1.5	3.2	**35.4**	**3.16**	18.9	11,220		35.9	3.0	33.1	3.7	**46.5**	**4.14**
	4.4	-2.3	3.0	0.9	3.5	**38.7**	**3.39**	19.4	11,418		36.2	3.0	33.3	3.9	**50.1**	**4.39**

* Compressor current is for 460-3-60; multiply by 2.2 for 208-3-60, by 0.8 for 575-3-60.

W-240-H**-P-*D-PP *R410a, 60 Hz, 2 x GSD60120VAB (460-3-60)*

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Ice Cooling (Btu/hr)**	**EER**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
ICE	5	-3	60	2	3.4	**88,100**	**6.6**	17.4	13,352	85	95	60	89	4.3	**130,300**	**2.86**
	10	2	60	6	3.7	**98,000**	**7.2**	17.9	13,597		95	60	90	4.7	**141,500**	**3.05**
	15	6	60	11	4.2	**108,800**	**7.9**	18.4	13,837		95	60	90	5.1	**153,600**	**3.25**
	20	10	60	15	4.6	**120,300**	**8.6**	18.9	14,077		96	60	91	5.5	**166,300**	**3.46**
	25	15	60	20	5.1	**132,800**	**9.3**	19.4	14,303		96	60	91	6.0	**180,000**	**3.69**
	30	19	60	24	5.6	**146,100**	**10.0**	19.9	14,549		96	60	92	6.5	**194,600**	**3.92**
	35	24	60	29	6.1	**160,400**	**10.8**	20.4	14,804		97	60	92	7.0	**210,200**	**4.16**
	40	28	60	33	6.7	**175,600**	**11.7**	21.0	15,071		97	60	93	7.6	**226,800**	**4.41**

METRIC

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Ice Cooling (kW)**	**COP_C**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
ICE	-15.0	-19.3	3.8	-16.9	1.9	**25.8**	**1.93**	17.4	13,352	29.4	34.7	3.8	31.8	2.4	**38.2**	**2.86**
	-12.2	-16.9	3.8	-14.3	2.1	**28.7**	**2.11**	17.9	13,597		34.9	3.8	32.0	2.6	**41.5**	**3.05**
	-9.4	-14.4	3.8	-11.7	2.3	**31.9**	**2.30**	18.4	13,837		35.2	3.8	32.2	2.8	**45.0**	**3.25**
	-6.7	-12.0	3.8	-9.3	2.6	**35.3**	**2.51**	18.9	14,077		35.4	3.8	32.5	3.1	**48.7**	**3.46**
	-3.9	-9.6	3.8	-6.7	2.8	**38.9**	**2.72**	19.4	14,303		35.6	3.8	32.7	3.3	**52.8**	**3.69**
	-1.1	-7.1	3.8	-4.2	3.1	**42.8**	**2.94**	19.9	14,549		35.8	3.8	33.0	3.6	**57.0**	**3.92**
	1.7	-4.7	3.8	-1.7	3.4	**47.0**	**3.17**	20.4	14,804		36.0	3.8	33.3	3.9	**61.6**	**4.16**
	4.4	-2.2	3.8	0.7	3.7	**51.5**	**3.41**	21.0	15,071		36.2	3.8	33.6	4.2	**66.5**	**4.41**

* Compressor current is for 460-3-60; multiply by 2.2 for 208-3-60, by 0.8 for 575-3-60.

go to TABLE OF CONTENTS

Performance Tables - W-Series (Ice Making/Arena Application)

W-300-H**-P-*D-PP *R410a, 60 Hz, 2 x GSD60137VAB (460-3-60)*

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Ice Cooling (Btu/hr)**	**EER**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
ICE	5	-3	72	2	3.1	**98,600**	**6.5**	19.8	15,148	85	95	72	**89**	4.1	**146,100**	**2.83**
	10	2	72	7	3.5	**109,800**	**7.1**	20.3	15,401		95	72	**89**	4.4	**158,700**	**3.02**
	15	6	72	11	3.9	**121,900**	**7.8**	20.9	15,646		95	72	**90**	4.8	**172,200**	**3.23**
	20	10	72	16	4.3	**134,900**	**8.5**	21.4	15,887		96	72	**90**	5.2	**186,500**	**3.44**
	25	15	72	20	4.7	**148,900**	**9.2**	22.0	16,110		96	72	**91**	5.6	**201,800**	**3.67**
	30	19	72	25	5.2	**163,900**	**10.0**	22.5	16,355		97	72	**91**	6.1	**218,200**	**3.91**
	35	24	72	29	5.7	**180,000**	**10.8**	23.1	16,609		97	72	**92**	6.6	**235,700**	**4.16**
	40	28	72	34	6.3	**197,200**	**11.7**	23.7	16,878		97	72	**92**	7.1	**254,400**	**4.42**

METRIC

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Ice Cooling (kW)**	**COP_C**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
ICE	-15.0	-19.4	4.5	-16.7	1.7	**28.9**	**1.91**	19.8	15,148	29.4	34.8	4.5	31.7	2.3	**42.8**	**2.83**
	-12.2	-16.9	4.5	-14.1	1.9	**32.2**	**2.09**	20.3	15,401		35.0	4.5	31.8	2.4	**46.5**	**3.02**
	-9.4	-14.5	4.5	-11.6	2.2	**35.7**	**2.28**	20.9	15,646		35.2	4.5	32.1	2.7	**50.5**	**3.23**
	-6.7	-12.1	4.5	-9.1	2.4	**39.5**	**2.49**	21.4	15,887		35.4	4.5	32.3	2.9	**54.7**	**3.44**
	-3.9	-9.6	4.5	-6.5	2.6	**43.6**	**2.71**	22.0	16,110		35.6	4.5	32.5	3.1	**59.1**	**3.67**
	-1.1	-7.2	4.5	-4.0	2.9	**48.0**	**2.94**	22.5	16,355		35.8	4.5	32.8	3.4	**64.0**	**3.91**
	1.7	-4.7	4.5	-1.5	3.2	**52.8**	**3.18**	23.1	16,609		36.1	4.5	33.1	3.7	**69.1**	**4.16**
	4.4	-2.3	4.5	0.9	3.5	**57.8**	**3.42**	23.7	16,878		36.3	4.5	33.3	3.9	**74.6**	**4.42**

* Compressor current is for 460-3-60; multiply by 2.2 for 208-3-60, by 0.8 for 575-3-60.

W-400-H**-P-*D-PP *R410a, 60 Hz, 2 x GSD60182VAB (460-3-60)*

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Ice Cooling (Btu/hr)**	**EER**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
ICE	5	-3	100	2	3.0	**131,000**	**6.7**	26.5	19,623	85	94	100	89	3.8	**192,300**	**2.87**
	10	2	100	7	3.4	**146,300**	**7.3**	27.3	20,009		95	100	89	4.2	**209,600**	**3.07**
	15	6	100	11	3.7	**162,700**	**8.0**	28.2	20,393		95	100	90	4.6	**228,100**	**3.28**
	20	11	100	16	4.1	**180,100**	**8.7**	29.0	20,777		96	100	90	5.0	**247,500**	**3.49**
	25	15	100	20	4.6	**198,900**	**9.4**	29.8	21,143		96	100	90	5.4	**268,300**	**3.72**
	30	19	100	25	5.0	**218,800**	**10.2**	30.7	21,539		96	100	91	5.8	**290,300**	**3.95**
	35	24	100	30	5.5	**240,100**	**10.9**	31.6	21,945		97	100	91	6.3	**313,700**	**4.19**
	40	28	100	34	6.0	**262,700**	**11.7**	32.4	22,367		97	100	92	6.8	**338,500**	**4.44**

METRIC

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Ice Cooling (kW)**	**COP_C**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
ICE	-15.0	-19.3	6.3	-16.7	1.7	**38.4**	**1.96**	26.5	19,623	29.4	34.7	6.3	31.5	2.1	**56.4**	**2.87**
	-12.2	-16.8	6.3	-14.1	1.9	**42.9**	**2.14**	27.3	20,009		34.9	6.3	31.7	2.3	**61.4**	**3.07**
	-9.4	-14.4	6.3	-11.5	2.1	**47.7**	**2.34**	28.2	20,393		35.1	6.3	32.0	2.6	**66.9**	**3.28**
	-6.7	-11.9	6.3	-9.0	2.3	**52.8**	**2.54**	29.0	20,777		35.3	6.3	32.2	2.8	**72.5**	**3.49**
	-3.9	-9.5	6.3	-6.5	2.6	**58.3**	**2.76**	29.8	21,143		35.5	6.3	32.4	3.0	**78.6**	**3.72**
	-1.1	-7.1	6.3	-3.9	2.8	**64.1**	**2.98**	30.7	21,539		35.7	6.3	32.6	3.2	**85.1**	**3.95**
	1.7	-4.6	6.3	-1.4	3.1	**70.4**	**3.21**	31.6	21,945		35.9	6.3	32.9	3.5	**91.9**	**4.19**
	4.4	-2.2	6.3	1.1	3.3	**77.0**	**3.44**	32.4	22,367		36.2	6.3	33.2	3.8	**99.2**	**4.44**

* Compressor current is for 460-3-60; multiply by 2.2 for 208-3-60, by 0.8 for 575-3-60.

go to TABLE OF CONTENTS

Performance Tables - W-Series (Ice Making/Arena Application)

W-500-H**-P-*D-PP *R410a, 60 Hz, 2 x GSD80235VWB (460-3-60)*

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Ice Cooling (Btu/hr)**	**EER**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
ICE	5	-3	120	2	3.3	**170,700**	**6.6**	32.8	25,848	85	95	120	89	4.2	**250,500**	**2.84**
	10	2	120	6	3.7	**191,500**	**7.2**	33.9	26,434		95	120	90	4.6	**274,200**	**3.04**
	15	6	120	11	4.1	**213,500**	**7.9**	35.0	26,965		95	120	90	5.0	**298,900**	**3.25**
	20	10	120	16	4.5	**236,400**	**8.6**	36.1	27,444		96	120	90	5.4	**324,300**	**3.46**
	25	15	120	20	5.0	**260,800**	**9.4**	37.0	27,839		96	120	91	5.9	**350,900**	**3.69**
	30	19	120	25	5.5	**286,200**	**10.1**	38.0	28,226		96	120	91	6.3	**378,500**	**3.93**
	35	24	120	29	6.0	**313,100**	**11.0**	38.9	28,574		97	120	92	6.8	**407,500**	**4.18**
	40	28	120	34	6.5	**341,400**	**11.8**	39.7	28,892		97	120	92	7.3	**437,800**	**4.44**

METRIC

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Ice Cooling (kW)**	**COP_C**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
ICE	-15.0	-19.3	7.6	-16.8	1.8	**50.0**	**1.93**	32.8	25,848	29.4	34.7	7.6	31.7	2.3	**73.4**	**2.84**
	-12.2	-16.9	7.6	-14.3	2.1	**56.1**	**2.12**	33.9	26,434		34.9	7.6	32.0	2.6	**80.4**	**3.04**
	-9.4	-14.4	7.6	-11.7	2.3	**62.6**	**2.32**	35.0	26,965		35.2	7.6	32.2	2.8	**87.6**	**3.25**
	-6.7	-12.0	7.6	-9.2	2.5	**69.3**	**2.52**	36.1	27,444		35.4	7.6	32.4	3.0	**95.0**	**3.46**
	-3.9	-9.6	7.6	-6.7	2.8	**76.4**	**2.75**	37.0	27,839		35.6	7.6	32.7	3.3	**102.8**	**3.69**
	-1.1	-7.1	7.6	-4.2	3.1	**83.9**	**2.97**	38.0	28,226		35.8	7.6	32.9	3.5	**110.9**	**3.93**
	1.7	-4.7	7.6	-1.6	3.3	**91.8**	**3.21**	38.9	28,574		36.0	7.6	33.2	3.8	**119.4**	**4.18**
	4.4	-2.2	7.6	0.8	3.6	**100.1**	**3.46**	39.7	28,892		36.2	7.6	33.5	4.1	**128.3**	**4.44**

* Compressor current is for 460-3-60; multiply by 0.8 for 575-3-60.

W-600-H**-P-*D-PP *R410a, 60 Hz, 2 x GSD80295VWB (460-3-60)*

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Ice Cooling (Btu/hr)**	**EER**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
ICE	5	-3	150	2	3.3	**215,400**	**6.6**	39.8	32,478	85	94	150	89	4.2	**315,400**	**2.85**
	10	2	150	6	3.7	**241,300**	**7.3**	41.1	33,112		95	150	90	4.6	**344,600**	**3.05**
	15	6	150	11	4.1	**268,700**	**8.0**	42.4	33,723		95	150	90	5.0	**375,200**	**3.26**
	20	11	150	15	4.6	**297,400**	**8.7**	43.7	34,311		96	150	90	5.4	**407,000**	**3.48**
	25	15	150	20	5.0	**328,000**	**9.4**	44.9	34,827		96	150	91	5.9	**440,500**	**3.71**
	30	19	150	25	5.5	**360,000**	**10.2**	46.2	35,362		96	150	91	6.3	**475,400**	**3.94**
	35	24	150	29	6.0	**394,000**	**11.0**	47.4	35,872		97	150	92	6.8	**512,200**	**4.18**
	40	28	150	33	6.6	**429,600**	**11.8**	48.5	36,355		97	150	92	7.3	**550,600**	**4.44**

METRIC

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Ice Cooling (kW)**	**COP_C**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
ICE	-15.0	-19.2	9.5	-16.8	1.8	**63.1**	**1.94**	39.8	32,478	29.4	34.6	9.5	31.7	2.3	**92.4**	**2.85**
	-12.2	-16.8	9.5	-14.3	2.1	**70.7**	**2.14**	41.1	33,112		34.8	9.5	32.0	2.6	**101.0**	**3.05**
	-9.4	-14.3	9.5	-11.7	2.3	**78.7**	**2.34**	42.4	33,723		35.1	9.5	32.2	2.8	**110.0**	**3.26**
	-6.7	-11.9	9.5	-9.3	2.6	**87.2**	**2.54**	43.7	34,311		35.3	9.5	32.4	3.0	**119.3**	**3.48**
	-3.9	-9.4	9.5	-6.7	2.8	**96.1**	**2.76**	44.9	34,827		35.4	9.5	32.7	3.3	**129.1**	**3.71**
	-1.1	-7.0	9.5	-4.2	3.1	**105.5**	**2.98**	46.2	35,362		35.7	9.5	32.9	3.5	**139.3**	**3.94**
	1.7	-4.6	9.5	-1.6	3.3	**115.5**	**3.22**	47.4	35,872		35.9	9.5	33.2	3.8	**150.1**	**4.18**
	4.4	-2.1	9.5	0.7	3.7	**125.9**	**3.46**	48.5	36,355		36.1	9.5	33.5	4.1	**161.4**	**4.44**

* Compressor current is for 460-3-60; multiply by 0.8 for 575-3-60.

go to TABLE OF CONTENTS

Performance Tables - W-Series (Ice Making/Arena Application)

W-800-H**-P-*D-PP *R410a, 60 Hz, 2 x GSD80385VWB (460-3-60)*

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Ice Cooling (Btu/hr)**	**EER**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP$_H$**
ICE	5	-3	190	2	3.4	**279,000**	**6.6**	53.2	42,491	85	94	190	89	4.3	**410,200**	**2.83**
	10	2	190	6	3.8	**312,800**	**7.2**	55.0	43,361		95	190	90	4.7	**448,300**	**3.03**
	15	6	190	11	4.2	**348,400**	**7.9**	56.7	44,179		95	190	90	5.1	**488,100**	**3.24**
	20	10	190	15	4.7	**385,900**	**8.6**	58.4	44,949		96	190	91	5.6	**529,700**	**3.45**
	25	15	190	20	5.1	**426,000**	**9.3**	60.0	45,612		96	190	91	6.0	**573,500**	**3.68**
	30	19	190	24	5.7	**468,000**	**10.1**	61.5	46,293		96	190	92	6.5	**619,200**	**3.92**
	35	24	190	29	6.2	**512,700**	**10.9**	63.1	46,939		97	190	92	7.0	**667,500**	**4.17**
	40	28	190	33	6.8	**559,700**	**11.8**	64.6	47,556		97	190	93	7.6	**718,000**	**4.42**

METRIC

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Ice Cooling (kW)**	**COP$_C$**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP$_H$**
ICE	-15.0	-19.3	12.0	-16.9	1.9	**81.8**	**1.93**	53.2	42,491	29.4	34.7	12.0	31.8	2.4	**120.2**	**2.83**
	-12.2	-16.9	12.0	-14.3	2.1	**91.7**	**2.11**	55.0	43,361		34.9	12.0	32.0	2.6	**131.4**	**3.03**
	-9.4	-14.4	12.0	-11.7	2.3	**102.1**	**2.31**	56.7	44,179		35.1	12.0	32.2	2.8	**143.0**	**3.24**
	-6.7	-12.0	12.0	-9.3	2.6	**113.1**	**2.52**	58.4	44,949		35.3	12.0	32.5	3.1	**155.2**	**3.45**
	-3.9	-9.6	12.0	-6.7	2.8	**124.8**	**2.74**	60.0	45,612		35.5	12.0	32.7	3.3	**168.1**	**3.68**
	-1.1	-7.1	12.0	-4.3	3.2	**137.2**	**2.96**	61.5	46,293		35.7	12.0	33.0	3.6	**181.5**	**3.92**
	1.7	-4.7	12.0	-1.7	3.4	**150.3**	**3.20**	63.1	46,939		35.9	12.0	33.3	3.9	**195.6**	**4.17**
	4.4	-2.2	12.0	0.6	3.8	**164.0**	**3.45**	64.6	47,556		36.2	12.0	33.6	4.2	**210.4**	**4.42**

* Compressor current is for 460-3-60; multiply by 0.8 for 575-3-60.

W-900-H**-P-*D-PP *R410a, 60 Hz, 2 x GSD80421VWB (460-3-60)*

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Ice Cooling (Btu/hr)**	**EER**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP$_H$**
ICE	5	-3	210	2	3.4	**307,600**	**6.7**	60.7	46,152	85	94	210	89	4.3	**449,800**	**2.86**
	10	2	210	6	3.7	**341,300**	**7.3**	62.8	47,065		95	210	90	4.7	**488,200**	**3.04**
	15	6	210	11	4.1	**378,400**	**7.9**	64.9	47,979		95	210	90	5.1	**530,000**	**3.24**
	20	10	210	15	4.6	**418,600**	**8.6**	67.0	48,893		96	210	91	5.5	**574,800**	**3.45**
	25	15	210	20	5.1	**462,800**	**9.3**	69.0	49,739		96	210	91	5.9	**623,500**	**3.67**
	30	19	210	24	5.6	**510,300**	**10.1**	71.0	50,639		96	210	91	6.4	**675,600**	**3.91**
	35	24	210	29	6.1	**562,000**	**10.9**	73.1	51,530		97	210	92	7.0	**731,900**	**4.16**
	40	28	210	33	6.7	**617,400**	**11.8**	75.2	52,408		97	210	93	7.5	**791,900**	**4.43**

METRIC

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Ice Cooling (kW)**	**COP$_C$**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP$_H$**
ICE	-15.0	-19.4	13.2	-16.9	1.9	**90.1**	**1.95**	60.7	46,152	29.4	34.7	13.2	31.8	2.4	**131.8**	**2.86**
	-12.2	-16.9	13.2	-14.3	2.1	**100.0**	**2.12**	62.8	47,065		34.9	13.2	32.0	2.6	**143.1**	**3.04**
	-9.4	-14.5	13.2	-11.7	2.3	**110.9**	**2.31**	64.9	47,979		35.1	13.2	32.2	2.8	**155.3**	**3.24**
	-6.7	-12.1	13.2	-9.3	2.6	**122.7**	**2.51**	67.0	48,893		35.3	13.2	32.5	3.1	**168.5**	**3.45**
	-3.9	-9.6	13.2	-6.7	2.8	**135.6**	**2.73**	69.0	49,739		35.5	13.2	32.7	3.3	**182.7**	**3.67**
	-1.1	-7.2	13.2	-4.2	3.1	**149.6**	**2.95**	71.0	50,639		35.7	13.2	33.0	3.6	**198.0**	**3.91**
	1.7	-4.7	13.2	-1.7	3.4	**164.7**	**3.20**	73.1	51,530		35.9	13.2	33.3	3.9	**214.5**	**4.16**
	4.4	-2.3	13.2	0.7	3.7	**180.9**	**3.45**	75.2	52,408		36.2	13.2	33.6	4.2	**232.1**	**4.43**

* Compressor current is for 460-3-60; multiply by 0.8 for 575-3-60.

go to TABLE OF CONTENTS

Performance Tables - W-Series (Ice Making/Arena Application)

W-1000-H**-P-*D-PP *R410a, 60 Hz, 2 x GSD80485VWB (460-3-60)*

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	**Ice Cooling (Btu/hr)**	**EER**	Compressor Current (A)*	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
ICE	5	-3	225	1	3.6	**351,300**	**6.5**	68.1	53,700	85	94.6	225.0	89.6	4.6	**518,600**	**2.83**
	10	2	225	6	4.0	**390,200**	**7.2**	70.0	54,548		95.0	225.0	90.0	5.0	**562,100**	**3.02**
	15	6	225	11	4.4	**432,900**	**7.8**	72.0	55,452		95.4	225.0	90.4	5.4	**609,500**	**3.22**
	20	10	225	15	4.9	**479,100**	**8.5**	74.1	56,401		95.8	225.0	90.9	5.9	**660,600**	**3.43**
	25	15	225	20	5.4	**530,000**	**9.3**	76.1	57,306		96.1	225.0	91.4	6.4	**716,300**	**3.66**
	30	19	225	24	6.0	**584,500**	**10.0**	78.2	58,298		96.5	225.0	91.9	6.9	**775,800**	**3.90**
	35	24	225	28	6.6	**643,800**	**10.9**	80.3	59,289		96.9	225.0	92.5	7.5	**840,100**	**4.15**
	40	28	225	33	7.2	**707,400**	**11.7**	82.4	60,258		97.3	225.0	93.1	8.1	**908,700**	**4.42**

METRIC

	EVAPORATOR LOOP *(50% Propylene Glycol)*							ELECTRICAL		CONDENSER LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	**Ice Cooling (kW)**	**COP_C**	Compressor Current (A)*	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
ICE	-15.0	-19.4	14.2	-17.0	2.0	**103.0**	**1.92**	68.1	53,700	29.4	34.8	14.2	32.0	2.6	**152.0**	**2.83**
	-12.2	-16.9	14.2	-14.4	2.2	**114.4**	**2.10**	70.0	54,548		35.0	14.2	32.2	2.8	**164.7**	**3.02**
	-9.4	-14.5	14.2	-11.8	2.4	**126.9**	**2.29**	72.0	55,452		35.2	14.2	32.4	3.0	**178.6**	**3.22**
	-6.7	-12.1	14.2	-9.4	2.7	**140.4**	**2.49**	74.1	56,401		35.4	14.2	32.7	3.3	**193.6**	**3.43**
	-3.9	-9.6	14.2	-6.9	3.0	**155.3**	**2.71**	76.1	57,306		35.6	14.2	33.0	3.6	**209.9**	**3.66**
	-1.1	-7.2	14.2	-4.4	3.3	**171.3**	**2.94**	78.2	58,298		35.8	14.2	33.2	3.8	**227.4**	**3.90**
	1.7	-4.7	14.2	-2.0	3.7	**188.7**	**3.18**	80.3	59,289		36.1	14.2	33.6	4.2	**246.2**	**4.15**
	4.4	-2.3	14.2	0.4	4.0	**207.3**	**3.44**	82.4	60,258		36.3	14.2	33.9	4.5	**266.3**	**4.42**

* Compressor current is for 460-3-60; multiply by 0.8 for 575-3-60.

go to TABLE OF CONTENTS

Performance Tables - WH-Series

WH-150-H**-B-*D-PP

R134a, 60 Hz, 2 x ZR68KCE-TFD (460-3-60)

HEATING

OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating** (Btu/hr)	**COP_H**
50	40	36	46	-4.0	71,900	11.8	7,334	115	125	36	**120**	5.4	**96,600**	**3.86**
60	49	36	55	-4.8	86,700	12.1	7,521	114	126	36		6.2	**112,000**	**4.36**
70	58	36	64	-5.8	103,800	12.3	7,731	113	126	36		7.2	**129,800**	**4.92**
80	67	36	73	-6.8	123,200	12.6	7,967	112	126	36		8.3	**150,000**	**5.52**
90	76	36	82	-8.1	145,300	13.0	8,235	110	126	36		9.6	**173,100**	**6.16**
50	41	36	47	-3.5	62,200	13.0	8,678	135	145	36	**140**	5.1	**91,500**	**3.09**
60	50	36	56	-4.2	75,000	13.3	8,869	134	145	36		5.8	**104,900**	**3.47**
70	59	36	65	-5.0	89,500	13.6	9,081	133	145	36		6.7	**120,100**	**3.88**
80	68	36	74	-5.9	106,000	13.9	9,318	132	146	36		7.6	**137,400**	**4.32**
90	77	36	83	-6.9	124,600	14.2	9,586	131	146	36		8.7	**157,000**	**4.80**
50	42	36	47	-2.9	52,500	14.7	10,316	155	165	36	**160**	4.9	**87,300**	**2.48**
60	51	36	57	-3.5	63,300	15.0	10,523	155	165	36		5.5	**98,900**	**2.75**
70	60	36	66	-4.2	75,500	15.3	10,749	154	165	36		6.2	**111,800**	**3.05**
80	69	36	75	-5.0	89,400	15.7	10,987	153	165	36		7.0	**126,500**	**3.37**
90	78	36	84	-5.8	104,900	16.0	11,266	152	165	36		8.0	**143,000**	**3.72**

COOLING*

ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling** (Btu/hr)	**EER**
60**								54						
65**														
70**														
75**														
80														
85														
90														
95														

METRIC

HEATING (METRIC)

OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating** (kW)	**COP_H**
10.0	4.4	2.3	7.8	-2.2	21.1	11.8	7,334	45.9	51.8	2.3	**49**	3.0	**28.3**	**3.86**
15.6	9.4	2.3	12.9	-2.7	25.4	12.1	7,521	45.4	51.9	2.3		3.4	**32.8**	**4.36**
21.1	14.4	2.3	17.9	-3.2	30.4	12.3	7,731	44.9	52.1	2.3		4.0	**38.0**	**4.92**
26.7	19.4	2.3	22.9	-3.8	36.1	12.6	7,967	44.3	52.3	2.3		4.6	**44.0**	**5.52**
32.2	24.4	2.3	27.7	-4.5	42.6	13.0	8,235	43.6	52.4	2.3		5.3	**50.7**	**6.16**
10.0	5.0	2.3	8.1	-1.9	18.2	13.0	8,678	57.2	62.7	2.3	**60**	2.8	**26.8**	**3.09**
15.6	10.0	2.3	13.3	-2.3	22.0	13.3	8,869	56.8	62.8	2.3		3.2	**30.7**	**3.47**
21.1	15.0	2.3	18.3	-2.8	26.2	13.6	9,081	56.3	62.9	2.3		3.7	**35.2**	**3.88**
26.7	20.0	2.3	23.4	-3.3	31.1	13.9	9,318	55.8	63.1	2.3		4.2	**40.3**	**4.32**
32.2	25.0	2.3	28.4	-3.8	36.5	14.2	9,586	55.2	63.2	2.3		4.8	**46.0**	**4.80**
10.0	5.7	2.3	8.4	-1.6	15.4	14.7	10,316	68.4	73.6	2.3	**71**	2.7	**25.6**	**2.48**
15.6	10.6	2.3	13.7	-1.9	18.6	15.0	10,523	68.1	73.7	2.3		3.1	**29.0**	**2.75**
21.1	15.6	2.3	18.8	-2.3	22.1	15.3	10,749	67.7	73.8	2.3		3.4	**32.8**	**3.05**
26.7	20.5	2.3	23.9	-2.8	26.2	15.7	10,987	67.2	73.9	2.3		3.9	**37.1**	**3.37**
32.2	25.4	2.3	29.0	-3.2	30.7	16.0	11,266	66.7	74.0	2.3		4.4	**41.9**	**3.72**

COOLING* (METRIC)

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling** (W)	**COP_C**
15.6**								12						
18.3**														
21.1**														
23.9**														
26.7														
29.4														
32.2														
35.0														

* *Cooling mode is available on reversing models (HAC), or by switching indoor and outdoor loops in tables.*
** *Lower cooling mode outdoor loop ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop.*
† *Compressor current listed is for 460-3-60; multiply by 2.2 for 208-3-60, by 0.8 for 575-3-60.*

go to TABLE OF CONTENTS

Performance Tables - WH-Series

WH-185-H**-B-*D-PP *R134a, 60 Hz, 2 x ZR94KCE-TFD (460-3-60)*

HEATING

OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
50	40	48	46	-4.3	104,000	20.6	10,418	114	125	48		5.8	**139,000**	**3.91**
60	49	48	55	-5.3	126,200	21.9	11,045	113	126	48		6.8	**163,300**	**4.33**
70	58	48	64	-6.3	151,200	23.1	11,563	112	126	48	**120**	7.9	**190,100**	**4.82**
80	67	48	73	-7.5	179,400	24.0	11,874	111	126	48		9.1	**219,400**	**5.42**
90	76	48	81	-8.8	210,600	24.7	11,908	110	127	48		10.5	**250,700**	**6.17**
50	41	48	46	-3.7	88,700	22.3	12,068	135	145	48		5.4	**129,300**	**3.14**
60	50	48	56	-4.5	107,700	23.5	12,696	134	145	48		6.3	**150,500**	**3.47**
70	59	48	65	-5.4	129,200	24.6	13,193	133	145	48	**140**	7.2	**173,700**	**3.86**
80	68	48	74	-6.4	153,400	25.4	13,461	132	146	48		8.3	**198,800**	**4.33**
90	77	48	83	-7.5	180,300	25.9	13,438	131	146	48		9.4	**225,600**	**4.92**
50	42	48	47	-3.0	72,400	24.6	13,941	155	165	48		5.0	**119,400**	**2.51**
60	51	48	56	-3.7	88,400	25.9	14,661	154	165	48		5.8	**137,900**	**2.76**
70	60	48	66	-4.5	106,800	27.1	15,220	153	165	48	**160**	6.6	**158,200**	**3.05**
80	69	48	75	-5.3	127,700	28.0	15,538	153	165	48		7.5	**180,200**	**3.40**
90	77	48	84	-6.3	150,900	28.5	15,572	152	165	48		8.5	**203,500**	**3.83**

COOLING*

ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	**EER**
60**														
65**														
70**														
75**														
80								54						
85														
90														
95														

METRIC

HEATING (METRIC)

OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
10.0	4.2	3.0	7.6	-2.4	30.5	20.6	10,418	45.7	51.8	3.0		3.2	**40.7**	**3.91**
15.6	9.2	3.0	12.7	-2.9	37.0	21.9	11,045	45.1	51.9	3.0		3.8	**47.9**	**4.33**
21.1	14.2	3.0	17.6	-3.5	44.3	23.1	11,563	44.5	52.2	3.0	**49**	4.4	**55.7**	**4.82**
26.7	19.2	3.0	22.5	-4.2	52.6	24.0	11,874	43.8	52.3	3.0		5.1	**64.3**	**5.42**
32.2	24.2	3.0	27.3	-4.9	61.7	24.7	11,908	43.1	52.5	3.0		5.8	**73.5**	**6.17**
10.0	4.8	3.0	7.9	-2.1	26.0	22.3	12,068	57.0	62.7	3.0		3.0	**37.9**	**3.14**
15.6	9.8	3.0	13.1	-2.5	31.6	23.5	12,696	56.5	62.8	3.0		3.5	**44.1**	**3.47**
21.1	14.8	3.0	18.1	-3.0	37.9	24.6	13,193	56.0	62.9	3.0	**60**	4.0	**50.9**	**3.86**
26.7	19.8	3.0	23.1	-3.6	45.0	25.4	13,461	55.4	63.1	3.0		4.6	**58.3**	**4.33**
32.2	24.8	3.0	28.0	-4.2	52.8	25.9	13,438	54.8	63.2	3.0		5.2	**66.1**	**4.92**
10.0	5.4	3.0	8.3	-1.7	21.2	24.6	13,941	68.3	73.6	3.0		2.8	**35.0**	**2.51**
15.6	10.4	3.0	13.5	-2.1	25.9	25.9	14,661	67.9	73.7	3.0		3.2	**40.4**	**2.76**
21.1	15.3	3.0	18.6	-2.5	31.3	27.1	15,220	67.4	73.8	3.0	**71**	3.7	**46.4**	**3.05**
26.7	20.3	3.0	23.8	-2.9	37.4	28.0	15,538	66.9	73.9	3.0		4.2	**52.8**	**3.40**
32.2	25.2	3.0	28.7	-3.5	44.2	28.5	15,572	66.4	74.0	3.0		4.7	**59.6**	**3.83**

COOLING* (METRIC)

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (W)**	**COP_C**
15.6**														
18.3**														
21.1**														
23.9**														
26.7								12						
29.4														
32.2														
35.0														

* *Cooling mode is available on reversing models (HAC), or by switching indoor and outdoor loops in tables.*
** *Lower cooling mode outdoor loop ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop.*
† *Compressor current listed is for 460-3-60; multiply by 2.2 for 208-3-60, by 0.8 for 575-3-60.*

go to TABLE OF CONTENTS

Performance Tables - WH-Series

WH-240-H**-B-*D-PP *R134a, 60 Hz, 2 x ZR125KCE-TFD (460-3-60)*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP$_H$**
HEATING	50	39	60	46	-4.3	128,100	21.3	13,184	114	125	60		5.7	**172,300**	**3.83**
	60	48	60	55	-5.2	156,200	22.4	13,898	113	126	60		6.8	**202,800**	**4.28**
	70	57	60	64	-6.3	188,100	23.5	14,485	112	126	60	**120**	7.9	**236,700**	**4.79**
	80	66	60	73	-7.5	223,900	24.7	14,878	111	126	60		9.1	**273,900**	**5.40**
	90	75	60	81	-8.8	263,800	25.9	14,998	110	126	60		10.5	**314,200**	**6.14**
	50	40	60	46	-3.8	113,200	23.3	15,468	135	145	60		5.5	**165,200**	**3.13**
	60	49	60	55	-4.6	138,000	24.4	16,226	134	145	60		6.4	**192,600**	**3.48**
	70	58	60	65	-5.5	165,800	25.5	16,839	133	145	60	**140**	7.4	**222,500**	**3.87**
	80	67	60	73	-6.6	197,000	26.6	17,202	132	146	60		8.5	**254,900**	**4.34**
	90	76	60	82	-7.7	231,600	27.7	17,257	130	146	60		9.7	**289,700**	**4.92**
	50	42	60	47	-3.1	94,300	27.1	18,888	155	165	60		5.3	**157,900**	**2.45**
	60	51	60	56	-3.9	115,600	28.3	19,742	154	165	60		6.1	**182,200**	**2.70**
	70	59	60	65	-4.7	139,800	29.5	20,400	153	165	60	**160**	7.0	**208,600**	**3.00**
	80	68	60	74	-5.6	166,900	30.6	20,792	152	165	60		7.9	**237,100**	**3.34**
	90	77	60	83	-6.6	197,100	31.6	20,843	151	165	60		8.9	**267,400**	**3.76**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	**EER**
COOLING*	60**														
	65**														
	70**														
	75**								54						
	80														
	85														
	90														
	95														

METRIC

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP$_H$**
HEATING (METRIC)	10.0	4.1	3.8	7.6	-2.4	37.5	21.3	13,184	45.7	51.8	3.8		3.2	**50.5**	**3.83**
	15.6	9.1	3.8	12.7	-2.9	45.8	22.4	13,898	45.1	51.9	3.8		3.8	**59.4**	**4.28**
	21.1	14.1	3.8	17.6	-3.5	55.1	23.5	14,485	44.5	52.1	3.8	**49**	4.4	**69.4**	**4.79**
	26.7	19.1	3.8	22.5	-4.2	65.6	24.7	14,878	43.8	52.3	3.8		5.1	**80.3**	**5.40**
	32.2	24.1	3.8	27.3	-4.9	77.3	25.9	14,998	43.1	52.4	3.8		5.8	**92.1**	**6.14**
	10.0	4.7	3.8	7.9	-2.1	33.2	23.3	15,468	56.9	62.7	3.8		3.1	**48.4**	**3.13**
	15.6	9.7	3.8	13.0	-2.6	40.4	24.4	16,226	56.4	62.8	3.8		3.6	**56.5**	**3.48**
	21.1	14.7	3.8	18.0	-3.1	48.6	25.5	16,839	55.9	63.0	3.8	**60**	4.1	**65.2**	**3.87**
	26.7	19.7	3.8	23.0	-3.7	57.7	26.6	17,202	55.3	63.1	3.8		4.7	**74.7**	**4.34**
	32.2	24.7	3.8	27.9	-4.3	67.9	27.7	17,257	54.6	63.2	3.8		5.4	**84.9**	**4.92**
	10.0	5.3	3.79	8.3	-1.7	27.6	27.1	18,888	68.2	73.7	3.79		2.9	**46.3**	**2.45**
	15.6	10.3	3.79	13.4	-2.2	33.9	28.3	19,742	67.7	73.8	3.79		3.4	**53.4**	**2.70**
	21.1	15.2	3.79	18.5	-2.6	41.0	29.5	20,400	67.2	73.9	3.79	**71**	3.9	**61.1**	**3.00**
	26.7	20.2	3.79	23.6	-3.1	48.9	30.6	20,792	66.7	74.0	3.79		4.4	**69.5**	**3.34**
	32.2	25.1	3.79	28.5	-3.7	57.8	31.6	20,843	66.2	74.1	3.79		4.9	**78.4**	**3.76**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (W)**	**COP$_C$**
COOLING* (METRIC)	15.6**														
	18.3**														
	21.1**														
	23.9**								12						
	26.7														
	29.4														
	32.2														
	35.0														

* *Cooling mode is available on reversing models (HAC), or by switching indoor and outdoor loops in tables.*
** *Lower cooling mode outdoor loop ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop.*
† *Compressor current listed is for 460-3-60; multiply by 2.2 for 208-3-60, by 0.8 for 575-3-60.*

go to TABLE OF CONTENTS

Performance Tables - WH-Series

WH-300-H**-B-*D-PP *R134a, 60 Hz, 2 x ZR144KCE-TFD (460-3-60)*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP$_H$**
HEATING	50	40	72	46	-4.3	153,200	24.7	15,659	114	126	72	**120**	5.7	**205,700**	**3.85**
	60	49	72	55	-5.5	196,100	25.6	16,251	113	126	72		7.0	**250,600**	**4.52**
	70	58	72	63	-6.7	240,100	26.6	16,791	112	126	72		8.2	**296,400**	**5.17**
	80	67	72	72	-7.8	281,100	28.1	17,276	111	126	72		9.4	**339,100**	**5.75**
	90	76	72	81	-8.7	313,900	30.1	17,707	110	127	72		10.4	**373,400**	**6.18**
	50	41	72	46	-3.7	134,800	27.7	18,593	135	145	72	**140**	5.5	**197,300**	**3.11**
	60	50	72	55	-4.8	170,900	28.8	19,337	133	145	72		6.6	**235,900**	**3.58**
	70	59	72	64	-5.8	208,400	29.9	19,914	132	145	72		7.7	**275,400**	**4.05**
	80	68	72	73	-6.8	243,700	31.4	20,357	131	146	72		8.7	**312,200**	**4.49**
	90	77	72	82	-7.6	273,200	33.2	20,617	131	146	72		9.5	**342,600**	**4.87**
	50	42	72	47	-3.1	109,900	30.9	21,861	155	164	72	**160**	5.1	**183,500**	**2.46**
	60	51	72	56	-4.0	142,700	32.1	22,725	154	165	72		6.1	**219,300**	**2.83**
	70	60	72	65	-4.9	176,200	33.4	23,393	153	165	72		7.1	**255,100**	**3.20**
	80	69	72	74	-5.8	207,700	34.7	23,800	152	165	72		8.0	**288,000**	**3.55**
	90	78	72	84	-6.5	234,000	36.3	23,963	151	165	72		8.8	**314,800**	**3.85**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	**EER**
COOLING*	60**								54						
	65**														
	70**														
	75**														
	80														
	85														
	90														
	95														

METRIC

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP$_H$**
HEATING (METRIC)	10.0	4.3	4.5	7.6	-2.4	44.9	24.7	15,659	45.7	51.9	4.5	**49**	3.2	**60.3**	**3.85**
	15.6	9.3	4.5	12.5	-3.1	57.5	25.6	16,251	45.0	52.1	4.5		3.9	**73.4**	**4.52**
	21.1	14.3	4.5	17.4	-3.7	70.4	26.6	16,791	44.3	52.3	4.5		4.6	**86.9**	**5.17**
	26.7	19.3	4.5	22.4	-4.3	82.4	28.1	17,276	43.7	52.4	4.5		5.2	**99.4**	**5.75**
	32.2	24.3	4.5	27.4	-4.8	92.0	30.1	17,707	43.1	52.6	4.5		5.8	**109.4**	**6.18**
	10.0	4.9	4.5	7.9	-2.1	39.5	27.7	18,593	56.9	62.7	4.5	**60**	3.1	**57.8**	**3.11**
	15.6	9.9	4.5	12.9	-2.7	50.1	28.8	19,337	56.3	62.9	4.5		3.7	**69.1**	**3.58**
	21.1	14.9	4.5	17.9	-3.2	61.1	29.9	19,914	55.7	63.0	4.5		4.3	**80.7**	**4.05**
	26.7	19.9	4.5	22.9	-3.8	71.4	31.4	20,357	55.2	63.2	4.5		4.8	**91.5**	**4.49**
	32.2	24.9	4.5	28.0	-4.2	80.1	33.2	20,617	54.7	63.3	4.5		5.3	**100.4**	**4.87**
	10.0	5.6	4.5	8.3	-1.7	32.2	30.9	21,861	68.3	73.6	4.5	**71**	2.8	**53.8**	**2.46**
	15.6	10.6	4.5	13.4	-2.2	41.8	32.1	22,725	67.7	73.7	4.5		3.4	**64.3**	**2.83**
	21.1	15.5	4.5	18.4	-2.7	51.6	33.4	23,393	67.2	73.8	4.5		3.9	**74.8**	**3.20**
	26.7	20.4	4.5	23.5	-3.2	60.9	34.7	23,800	66.7	73.9	4.5		4.4	**84.4**	**3.55**
	32.2	25.4	4.5	28.6	-3.6	68.6	36.3	23,963	66.2	74.1	4.5		4.9	**92.3**	**3.85**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (W)**	**COP$_C$**
COOLING* (METRIC)	15.6**								12						
	18.3**														
	21.1**														
	23.9**														
	26.7														
	29.4														
	32.2														
	35.0														

* *Cooling mode is available on reversing models (HAC), or by switching indoor and outdoor loops in tables.*
** *Lower cooling mode outdoor loop ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop.*
† *Compressor current listed is for 460-3-60; multiply by 2.2 for 208-3-60, by 0.8 for 575-3-60.*

go to TABLE OF CONTENTS

Performance Tables - WH-Series

WH-400-H**-B-*D-PP *R134a, 60 Hz, 2 x ZR190KCE-TED (460-3-60)*

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP$_H$**
HEATING	50	40	100	46	-4.0	198,700	37.4	20,219	115	125	100		5.3	**266,300**	**3.86**
	60	49	100	55	-4.9	243,400	38.3	20,777	114	126	100		6.3	**312,900**	**4.41**
	70	58	100	64	-5.9	294,400	39.2	21,450	113	126	100	**120**	7.3	**366,200**	**5.00**
	80	67	100	73	-7.0	351,800	40.4	22,319	112	126	100		8.5	**426,600**	**5.60**
	90	76	100	82	-8.3	416,400	41.8	23,394	110	126	100		9.9	**494,900**	**6.20**
	50	41	100	47	-3.5	176,100	43.5	24,734	135	145	100		5.2	**259,100**	**3.07**
	60	50	100	56	-4.3	215,300	44.2	25,165	134	145	100		6.0	**299,800**	**3.49**
	70	59	100	65	-5.2	258,800	45.1	25,741	133	145	100	**140**	6.9	**345,300**	**3.93**
	80	68	100	74	-6.2	307,300	46.0	26,451	132	146	100		7.9	**396,200**	**4.39**
	90	77	100	83	-7.2	360,900	47.2	27,368	131	146	100		9.1	**452,900**	**4.85**
	50	42	100	47	-2.9	147,000	50.6	29,850	155	165	100		5.0	**247,500**	**2.43**
	60	51	100	56	-3.6	181,700	51.2	30,188	154	165	100		5.7	**283,300**	**2.75**
	70	60	100	66	-4.4	219,500	52.0	30,628	154	165	100	**160**	6.5	**322,600**	**3.09**
	80	69	100	75	-5.2	260,400	52.8	31,206	153	165	100		7.3	**365,500**	**3.43**
	90	77	100	84	-6.1	304,600	53.8	31,967	152	165	100		8.3	**412,300**	**3.78**

	ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	**EER**
COOLING*	60**														
	65**														
	70**														
	75**								54						
	80														
	85														
	90														
	95														

METRIC

	OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
	ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP$_H$**
HEATING (METRIC)	10.0	4.2	6.3	7.8	-2.2	58.2	37.4	20,219	45.9	51.8	6.3		2.9	**78.0**	**3.86**
	15.6	9.2	6.3	12.9	-2.7	71.3	38.3	20,777	45.4	52.0	6.3		3.5	**91.7**	**4.41**
	21.1	14.2	6.3	17.8	-3.3	86.3	39.2	21,450	44.8	52.1	6.3	**49**	4.1	**107.3**	**5.00**
	26.7	19.2	6.3	22.8	-3.9	103.1	40.4	22,319	44.2	52.3	6.3		4.7	**125.0**	**5.60**
	32.2	24.2	6.3	27.6	-4.6	122.0	41.8	23,394	43.4	52.4	6.3		5.5	**145.0**	**6.20**
	10.0	4.8	6.3	8.1	-1.9	51.6	43.5	24,734	57.1	62.7	6.3		2.9	**75.9**	**3.07**
	15.6	9.8	6.3	13.2	-2.4	63.1	44.2	25,165	56.7	62.8	6.3		3.3	**87.9**	**3.49**
	21.1	14.8	6.3	18.2	-2.9	75.8	45.1	25,741	56.2	62.9	6.3	**60**	3.8	**101.2**	**3.93**
	26.7	19.8	6.3	23.3	-3.4	90.1	46.0	26,451	55.6	63.1	6.3		4.4	**116.1**	**4.39**
	32.2	24.8	6.3	28.2	-4.0	105.8	47.2	27,368	54.9	63.2	6.3		5.1	**132.7**	**4.85**
	10.0	5.4	6.3	8.4	-1.6	43.1	50.6	29,850	68.3	73.7	6.3		2.8	**72.5**	**2.43**
	15.6	10.4	6.3	13.6	-2.0	53.3	51.2	30,188	67.9	73.8	6.3		3.2	**83.0**	**2.75**
	21.1	15.3	6.3	18.7	-2.4	64.3	52.0	30,628	67.5	73.9	6.3	**71**	3.6	**94.5**	**3.09**
	26.7	20.3	6.3	23.8	-2.9	76.3	52.8	31,206	67.1	74.0	6.3		4.1	**107.1**	**3.43**
	32.2	25.2	6.3	28.8	-3.4	89.3	53.8	31,967	66.5	74.1	6.3		4.6	**120.8**	**3.78**

	ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (W)**	**COP$_C$**
COOLING* (METRIC)	15.6**														
	18.3**														
	21.1**														
	23.9**								12						
	26.7														
	29.4														
	32.2														
	35.0														

* *Cooling mode is available on reversing models (HAC), or by switching indoor and outdoor loops in tables.*
** *Lower cooling mode outdoor loop ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop.*
† *Compressor current listed is for 460-3-60; multiply by 2.2 for 208-3-60, by 0.8 for 575-3-60.*

go to TABLE OF CONTENTS

Performance Tables - WH-Series

WH-500-H**-B-*D-PP *R134a, 60 Hz, 2 x ZR250KCE-TED (460-3-60)*

HEATING

OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
50	39	120	46	-4.3	260,600	38.7	26,651	114	125	120	**120**	5.8	**349,200**	**3.84**
60	48	120	55	-5.3	317,200	39.8	27,501	113	126	120		6.8	**408,700**	**4.36**
70	57	120	64	-6.4	382,700	40.9	28,460	112	126	120		8.0	**477,500**	**4.92**
80	66	120	72	-7.6	458,400	42.2	29,507	111	126	120		9.3	**556,800**	**5.53**
90	75	120	81	-9.1	545,000	43.7	30,706	109	126	120		10.8	**647,500**	**6.18**
50	41	120	46	-3.8	230,500	45.5	32,613	134	145	120	**140**	5.7	**339,400**	**3.05**
60	50	120	55	-4.7	279,000	46.4	33,326	134	145	120		6.5	**390,400**	**3.43**
70	59	120	64	-5.6	334,700	47.3	34,121	133	145	120		7.5	**448,800**	**3.85**
80	68	120	73	-6.7	398,700	48.2	34,960	131	145	120		8.6	**515,700**	**4.32**
90	77	120	82	-7.9	471,500	49.2	35,909	130	146	120		9.9	**591,800**	**4.83**
50	42	120	47	-3.2	191,500	53.4	39,315	155	165	120	**160**	5.4	**323,300**	**2.41**
60	51	120	56	-3.9	232,500	54.1	39,916	154	165	120		6.1	**366,400**	**2.69**
70	60	120	65	-4.7	280,000	54.7	40,531	153	165	120		6.9	**416,000**	**3.01**
80	69	120	74	-5.6	334,600	55.4	41,189	152	165	120		7.9	**472,900**	**3.36**
90	78	120	83	-6.6	397,000	56.1	41,918	151	165	120		9.0	**537,800**	**3.76**

COOLING*

ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	**EER**
60**								54						
65**														
70**														
75**														
80														
85														
90														
95														

METRIC

HEATING (METRIC)

OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
10.0	4.1	7.6	7.6	-2.4	76.4	38.7	26,651	45.7	51.9	7.6	**49**	3.2	**102.3**	**3.84**
15.6	9.1	7.6	12.7	-2.9	93.0	39.8	27,501	45.1	52.0	7.6		3.8	**119.8**	**4.36**
21.1	14.1	7.6	17.5	-3.6	112.2	40.9	28,460	44.4	52.2	7.6		4.4	**139.9**	**4.92**
26.7	19.1	7.6	22.5	-4.2	134.3	42.2	29,507	43.7	52.3	7.6		5.2	**163.2**	**5.53**
32.2	24.1	7.6	27.1	-5.1	159.7	43.7	30,706	42.9	52.4	7.6		6.0	**189.8**	**6.18**
10.0	4.7	7.6	7.9	-2.1	67.6	45.5	32,613	56.8	62.6	7.6	**60**	3.2	**99.5**	**3.05**
15.6	9.7	7.6	13.0	-2.6	81.8	46.4	33,326	56.4	62.7	7.6		3.6	**114.4**	**3.43**
21.1	14.7	7.6	18.0	-3.1	98.1	47.3	34,121	55.8	62.9	7.6		4.2	**131.5**	**3.85**
26.7	19.7	7.6	23.0	-3.7	116.8	48.2	34,960	55.2	63.0	7.6		4.8	**151.1**	**4.32**
32.2	24.7	7.6	27.8	-4.4	138.2	49.2	35,909	54.5	63.1	7.6		5.5	**173.4**	**4.83**
10.0	5.6	7.6	8.2	-1.8	56.1	53.4	39,315	68.1	73.7	7.6	**71**	3.0	**94.8**	**2.41**
15.6	10.5	7.6	13.4	-2.2	68.1	54.1	39,916	67.7	73.8	7.6		3.4	**107.4**	**2.69**
21.1	15.4	7.6	18.5	-2.6	82.1	54.7	40,531	67.3	73.9	7.6		3.8	**121.9**	**3.01**
26.7	20.4	7.6	23.6	-3.1	98.1	55.4	41,189	66.7	74.0	7.6		4.4	**138.6**	**3.36**
32.2	25.3	7.6	28.5	-3.7	116.3	56.1	41,918	66.1	74.1	7.6		5.0	**157.6**	**3.76**

COOLING* (METRIC)

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (W)**	**COP_C**
15.6**								12						
18.3**														
21.1**														
23.9**														
26.7														
29.4														
32.2														
35.0														

* *Cooling mode is available on reversing models (HAC), or by switching indoor and outdoor loops in tables.*
** *Lower cooling mode outdoor loop ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop.*
† *Compressor current listed is for 460-3-60; multiply by 0.8 for 575-3-60.*

go to TABLE OF CONTENTS

Performance Tables - WH-Series

WH-600-H**-B-*D-PP

R134a, 60 Hz, 2 x ZR300KCE-TED (460-3-60)

HEATING

OUTDOOR LOOP (Water)						ELECTRICAL		INDOOR LOOP (Water)						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP_H**
50	40	150	46	-4.2	311,300	47.4	32,016	114	125	150	**120**	5.6	**417,300**	**3.82**
60	49	150	55	-5.1	378,900	49.9	33,784	113	126	150		6.6	**490,900**	**4.26**
70	58	150	64	-6.1	457,800	52.1	35,303	112	126	150		7.7	**575,100**	**4.77**
80	67	150	73	-7.3	548,600	53.9	36,468	111	126	150		8.9	**669,900**	**5.38**
90	76	150	81	-8.7	653,300	55.0	36,998	110	126	150		10.4	**776,400**	**6.15**
50	41	150	46	-3.7	275,400	55.9	39,102	135	145	150	**140**	5.4	**405,600**	**3.04**
60	50	150	56	-4.4	333,300	57.4	40,256	134	145	150		6.2	**467,400**	**3.40**
70	59	150	65	-5.3	400,100	59.1	41,463	133	145	150		7.2	**538,400**	**3.81**
80	68	150	74	-6.4	477,200	60.5	42,493	132	145	150		8.3	**619,000**	**4.27**
90	77	150	83	-7.5	565,200	61.5	43,235	131	146	150		9.5	**709,600**	**4.81**
50	42	150	47	-3.0	228,000	65.0	47,038	155	165	150	**160**	5.1	**385,200**	**2.40**
60	51	150	56	-3.7	276,900	66.0	47,632	154	165	150		5.8	**436,200**	**2.68**
70	60	150	66	-4.5	333,800	67.3	48,458	153	165	150		6.6	**496,000**	**3.00**
80	69	150	75	-5.3	399,600	68.6	49,391	153	165	150		7.5	**565,000**	**3.35**
90	78	150	84	-6.3	475,100	69.9	50,299	151	165	150		8.6	**643,600**	**3.75**

COOLING*

ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	**EER**
60**								54						
65**														
70**														
75**														
80														
85														
90														
95														

METRIC

HEATING (METRIC)

OUTDOOR LOOP (Water)						ELECTRICAL		INDOOR LOOP (Water)						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP_H**
10.0	4.2	9.5	7.7	-2.3	91.2	47.4	32,016	45.8	51.8	9.5	**49**	3.1	**122.3**	**3.82**
15.6	9.2	9.5	12.8	-2.8	111.0	49.9	33,784	45.2	52.0	9.5		3.7	**143.9**	**4.26**
21.1	14.2	9.5	17.7	-3.4	134.2	52.1	35,303	44.6	52.1	9.5		4.3	**168.5**	**4.77**
26.7	19.2	9.5	22.6	-4.1	160.8	53.9	36,468	43.9	52.3	9.5		4.9	**196.3**	**5.38**
32.2	24.2	9.5	27.4	-4.8	191.5	55.0	36,998	43.1	52.4	9.5		5.8	**227.5**	**6.15**
10.0	4.8	9.5	7.9	-2.1	80.7	55.9	39,102	57.0	62.6	9.5	**60**	3.0	**118.9**	**3.04**
15.6	9.8	9.5	13.2	-2.4	97.7	57.4	40,256	56.6	62.7	9.5		3.4	**137.0**	**3.40**
21.1	14.8	9.5	18.2	-2.9	117.3	59.1	41,463	56.0	62.8	9.5		4.0	**157.8**	**3.81**
26.7	19.8	9.5	23.1	-3.6	139.9	60.5	42,493	55.4	62.9	9.5		4.6	**181.4**	**4.27**
32.2	24.8	9.5	28.0	-4.2	165.6	61.5	43,235	54.7	63.1	9.5		5.3	**208.0**	**4.81**
10.0	5.5	9.5	8.3	-1.7	66.8	65.0	47,038	68.3	73.6	9.5	**71**	2.8	**112.9**	**2.40**
15.6	10.4	9.5	13.5	-2.1	81.2	66.0	47,632	67.9	73.7	9.5		3.2	**127.8**	**2.68**
21.1	15.4	9.5	18.6	-2.5	97.8	67.3	48,458	67.4	73.8	9.5		3.7	**145.4**	**3.00**
26.7	20.3	9.5	23.8	-2.9	117.1	68.6	49,391	66.9	73.9	9.5		4.2	**165.6**	**3.35**
32.2	25.3	9.5	28.7	-3.5	139.2	69.9	50,299	66.3	74.1	9.5		4.8	**188.6**	**3.75**

COOLING* (METRIC)

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (W)**	**COP_C**
15.6**								12						
18.3**														
21.1**														
23.9**														
26.7														
29.4														
32.2														
35.0														

* *Cooling mode is available on reversing models (HAC), or by switching indoor and outdoor loops in tables.*

** *Lower cooling mode outdoor loop ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop.*

† *Compressor current listed is for 460-3-60; multiply by 0.8 for 575-3-60.*

go to TABLE OF CONTENTS

Performance Tables - WH-Series

WH-800-H**-B-*D-PP *R134a, 60 Hz, 2 x ZR380KCE-TED (460-3-60)*

HEATING

OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°F)	Evap. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Abs. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Cond. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Heating (Btu/hr)**	**COP$_H$**
50	40	190	46	-4.1	393,000	59.8	40,538	114	126	190	**120**	5.6	**527,000**	**3.81**
60	49	190	55	-5.0	478,300	62.9	42,756	114	126	190		6.5	**619,900**	**4.25**
70	58	190	64	-6.1	577,600	65.8	44,711	112	126	190		7.6	**725,900**	**4.76**
80	67	190	73	-7.3	692,300	68.1	46,184	111	126	190		8.9	**845,700**	**5.37**
90	76	190	81	-8.7	824,000	69.5	46,930	110	127	190		10.3	**980,000**	**6.12**
50	41	190	46	-3.7	346,700	70.4	49,426	135	145	190	**140**	5.4	**511,000**	**3.03**
60	50	190	56	-4.4	419,700	72.4	50,905	134	145	190		6.2	**589,100**	**3.39**
70	59	190	65	-5.3	503,900	74.5	52,453	133	145	190		7.1	**678,600**	**3.79**
80	68	190	74	-6.3	601,200	76.3	53,786	132	146	190		8.2	**780,500**	**4.25**
90	77	190	83	-7.5	712,300	77.7	54,760	131	146	190		9.4	**895,000**	**4.79**
50	42	190	47	-3.0	287,200	81.6	59,225	155	165	190	**160**	5.1	**485,000**	**2.40**
60	51	190	56	-3.7	348,300	82.9	59,929	154	165	190		5.8	**548,500**	**2.68**
70	60	190	66	-4.4	419,200	84.4	60,925	153	165	190		6.6	**622,900**	**3.00**
80	69	190	75	-5.3	501,000	86.0	62,058	153	165	190		7.5	**708,600**	**3.35**
90	77	190	84	-6.3	594,600	87.6	63,159	152	165	190		8.5	**806,000**	**3.74**

COOLING*

ELT (°F)	Cond. Temp.	Flow (gpm)	LLT (°F)	Delta T (°F)	Heat Rej. (Btu/hr)	Compressor Current (A)†	Input Power (W)	EWT (°F)	Evap. Temp.	Flow (gpm)	LWT (°F)	Delta T (°F)	**Cooling (Btu/hr)**	**EER**
60**								54						
65**														
70**														
75**														
80														
85														
90														
95														

METRIC

HEATING (METRIC)

OUTDOOR LOOP *(Water)*						ELECTRICAL		INDOOR LOOP *(Water)*						
ELT (°C)	Evap. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Abs. (kW)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Cond. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Heating (kW)**	**COP$_H$**
10.0	4.2	12.0	7.7	-2.3	115.2	59.8	40,538	45.8	51.9	12.0	**49**	3.1	**154.4**	**3.81**
15.6	9.2	12.0	12.8	-2.8	140.2	62.9	42,756	45.3	52.1	12.0		3.6	**181.7**	**4.25**
21.1	14.2	12.0	17.7	-3.4	169.3	65.8	44,711	44.7	52.3	12.0		4.2	**212.7**	**4.76**
26.7	19.2	12.0	22.6	-4.1	202.9	68.1	46,184	43.9	52.4	12.0		4.9	**247.9**	**5.37**
32.2	24.2	12.0	27.4	-4.8	241.5	69.5	46,930	43.2	52.6	12.0		5.7	**287.2**	**6.12**
10.0	4.8	12.0	7.9	-2.1	101.6	70.4	49,426	57.0	62.7	12.0	**60**	3.0	**149.8**	**3.03**
15.6	9.8	12.0	13.2	-2.4	123.0	72.4	50,905	56.6	62.8	12.0		3.4	**172.6**	**3.39**
21.1	14.8	12.0	18.2	-2.9	147.7	74.5	52,453	56.1	62.9	12.0		3.9	**198.9**	**3.79**
26.7	19.8	12.0	23.2	-3.5	176.2	76.3	53,786	55.4	63.1	12.0		4.6	**228.7**	**4.25**
32.2	24.8	12.0	28.0	-4.2	208.8	77.7	54,760	54.8	63.2	12.0		5.2	**262.3**	**4.79**
10.0	5.4	12.0	8.3	-1.7	84.2	81.6	59,225	68.3	73.6	12.0	**71**	2.8	**142.1**	**2.40**
15.6	10.4	12.0	13.5	-2.1	102.1	82.9	59,929	67.9	73.7	12.0		3.2	**160.7**	**2.68**
21.1	15.3	12.0	18.7	-2.4	122.9	84.4	60,925	67.4	73.8	12.0		3.7	**182.6**	**3.00**
26.7	20.3	12.0	23.8	-2.9	146.8	86.0	62,058	66.9	73.9	12.0		4.2	**207.7**	**3.35**
32.2	25.2	12.0	28.7	-3.5	174.3	87.6	63,159	66.4	74.1	12.0		4.7	**236.2**	**3.74**

COOLING* (METRIC)

ELT (°C)	Cond. Temp.	Flow (L/s)	LLT (°C)	Delta T (°C)	Heat Rej. (W)	Compressor Current (A)†	Input Power (W)	EWT (°C)	Evap. Temp.	Flow (L/s)	LWT (°C)	Delta T (°C)	**Cooling (W)**	**COP$_C$**
15.6**								12						
18.3**														
21.1**														
23.9**														
26.7														
29.4														
32.2														
35.0														

* *Cooling mode is available on reversing models (HAC), or by switching indoor and outdoor loops in tables.*
** *Lower cooling mode outdoor loop ELT's may require flow control via accessory 0-10V modulating water valve in outdoor loop.*
† *Compressor current listed is for 460-3-60; multiply by 0.8 for 575-3-60.*

go to TABLE OF CONTENTS

Electrical Specifications - W-Series

Table 27 - W-Series Electrical Specifications

	Elec. Code	Power Supply			Compressors (each)		FLA	MCA	Maximum Fuse/Breaker	Minimum Wire Size
		V-ø-Hz	MIN	MAX	RLA	LRA	Amps	Amps	Amps	ga
W-150	1	208/230-1-60	187	253	36.9	185	74.3	83.5	100	#3-2
	2	208-3-60	187	229	23.2	164	47.3	53.1	80	#4-3
	4	460-3-60	414	506	11.2	75	22.9	25.7	40	#8-3
	5	575-3-60	518	632	7.9	54	16.3	18.3	25	#10-3
	6	220-1-50	187	253	28.2	155	56.9	64.0	80	#4-2
	7	380-3-50	342	418	11.2	75	22.9	25.7	40	#8-3
W-185	2	208-3-60	187	229	27.6	191	55.7	62.6	80	#4-3
	4	460-3-60	414	506	12.8	100	26.1	29.3	40	#8-3
	5	575-3-60	518	632	9.6	78	19.7	22.1	30	#10-3
	7	380-3-50	342	418	13.0	101	26.5	29.8	40	#8-3
W-240	2	208-3-60	187	229	40.4	217	81.7	91.8	125	#2-3
	4	460-3-60	414	506	21.2	122	42.9	48.2	60	#6-3
	5	575-3-60	518	632	15.4	85	31.3	35.2	50	#8-3
	7	380-3-50	342	418	22.4	136	45.3	50.9	60	#6-3
W-300	2	208-3-60	187	229	44.2	252	89.3	100.4	125	#2-3
	4	460-3-60	414	506	22.6	137	45.7	51.4	60	#6-3
	5	575-3-60	518	632	19.2	103	38.9	43.7	60	#6-3
	7	380-3-50	342	418	26.3	159	53.1	59.7	80	#4-3
W-400	2	208-3-60	187	229	57.7	330	116.3	130.7	150	#0-3
	4	460-3-60	414	506	26.9	180	54.3	61.0	80	#4-3
	5	575-3-60	518	632	21.5	132	43.5	48.9	60	#6-3
	7	380-3-50	342	418	30.9	192	62.3	70.0	100	#3-3
W-500	4	460-3-60	414	506	34.4	212	69.0	77.6	100	#3-3
	5	575-3-60	518	632	27.5	162	55.2	62.1	80	#4-3
	7	380-3-50	342	418	41.6	253	83.4	93.8	125	#2-3
W-600	4	460-3-60	414	506	39.7	212	79.6	89.5	125	#2-3
	5	575-3-60	518	632	31.8	168	63.8	71.8	100	#3-3
	7	380-3-50	342	418	48.1	252	96.4	108.4	150	#0-3
W-800	4	460-3-60	414	506	49.2	241	98.6	110.9	150	#0-3
	5	575-3-60	518	632	39.3	194	78.8	88.6	125	#2-3
	7	380-3-50	342	418	59.5	299	119.2	134.1	175	#00-3
W-900	4	460-3-60	414	506	53.4	280	107.0	120.4	150	#0-3
	5	575-3-60	518	632	42.7	225	85.6	96.3	125	#2-3
	7	380-3-50	342	418	64.6	355	129.4	145.6	200	#000-3
W-1000	4	460-3-60	414	506	55.5	290	111.2	125.1	150	#0-3
	5	575-3-60	518	632	44.4	255	89.0	100.1	125	#2-3
	7	380-3-50	342	418	67.2	355	134.6	151.4	200	#000-3

go to TABLE OF CONTENTS

Electrical Specifications - WH-Series

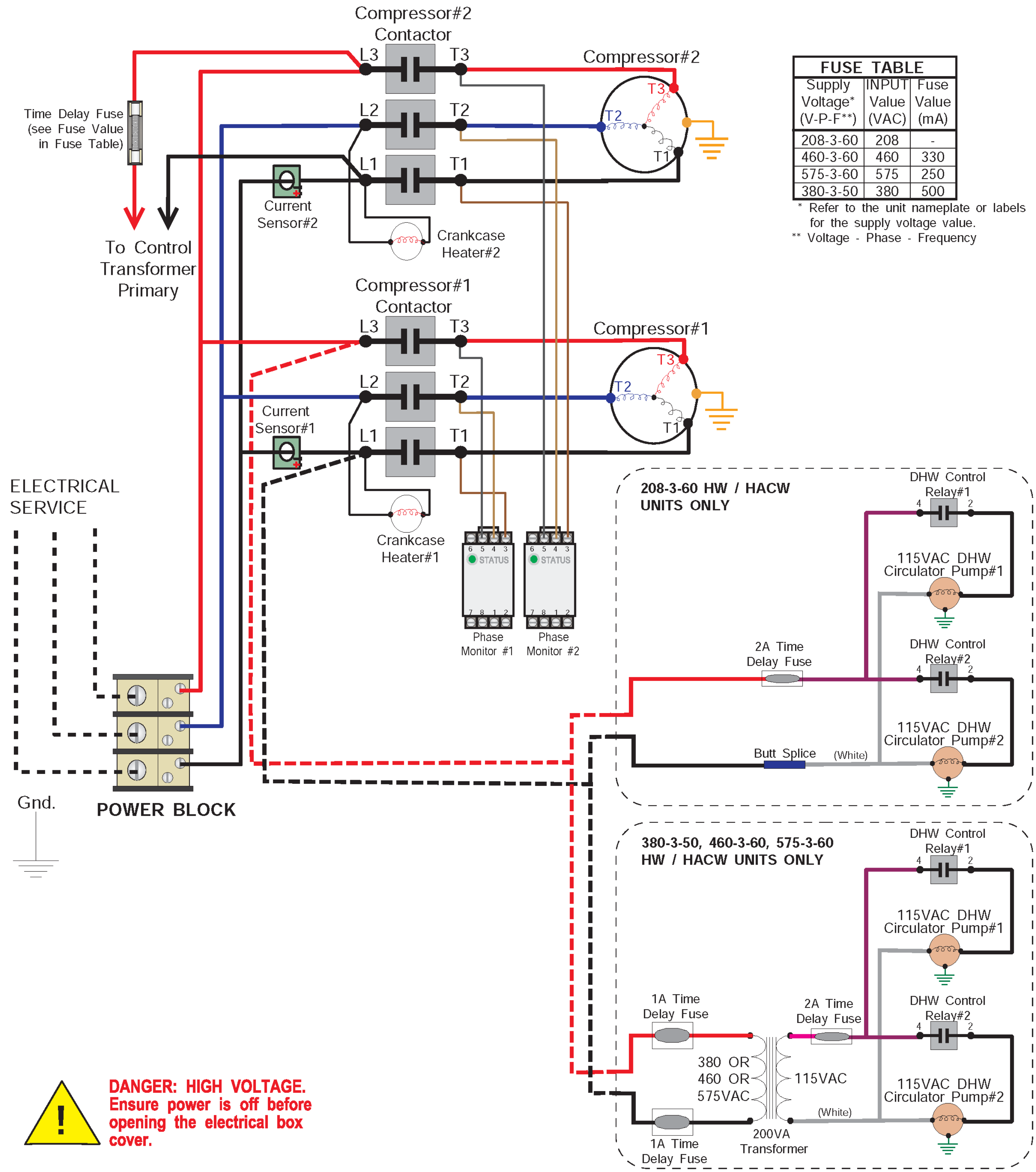
Table 28 - WH-Series Electrical Specifications

	Elec. Code	Power Supply			Compressors (each)		FLA	MCA	Maximum Fuse/Breaker	Minimum Wire Size
		V-ø-Hz	MIN	MAX	RLA	LRA	Amps	Amps	Amps	ga
WH-150	1	208/230-1-60	187	253	28.8	176	61.1	68.3	80	#4-2
	2	208-3-60	187	229	18.6	156	37.4	42.1	60	#6-3
	4	460-3-60	414	506	9.0	75	18.2	20.5	30	#10-3
	5	575-3-60	518	632	7.4	54	15.0	16.9	20	#12-3
	6	220-1-50	187	253	27.6	150	55.4	62.3	80	#4-2
	7	380-3-50	342	418	9.0	74	18.2	20.5	30	#10-3
WH-185	2	208-3-60	187	229	25.3	195	50.8	57.1	80	#4-3
	4	460-3-60	414	506	11.5	95	23.2	26.1	40	#8-3
	5	575-3-60	518	632	10.3	80	20.8	23.4	30	#10-3
	7	380-3-50	342	418	11.5	95	23.2	26.1	40	#8-3
WH-240	2	208-3-60	187	229	35.3	239	70.9	79.6	100	#3-3
	4	460-3-60	414	506	17.9	125	36.0	40.5	50	#8-3
	5	575-3-60	518	632	11.5	80	23.2	26.1	40	#8-3
	7	380-3-50	342	418	17.9	125	36.0	40.5	50	#8-3
WH-300	2	208-3-60	187	229	39.4	245	79.0	88.9	125	#2-3
	4	460-3-60	414	506	15.7	125	31.6	35.5	50	#8-3
	5	575-3-60	518	632	13.1	100	26.4	29.7	40	#8-3
	7	380-3-50	342	418	15.7	118	31.6	35.5	50	#8-3
WH-400	2	208-3-60	187	229	52.6	340	105.4	118.6	150	#0-3
	4	460-3-60	414	506	25.6	173	51.4	57.8	80	#4-3
	5	575-3-60	518	632	21.2	132	42.6	47.9	60	#6-3
	7	380-3-50	342	418	24.4	173	49.0	55.1	80	#4-3
WH-500	4	460-3-60	414	506	30.1	225	60.4	67.9	100	#3-3
	5	575-3-60	518	632	24.4	180	49.0	55.1	80	#4-3
	7	380-3-50	342	418	30.1	225	60.4	67.9	100	#3-3
WH-600	4	460-3-60	414	506	35.3	250	70.8	79.6	100	#3-3
	5	575-3-60	518	632	28.2	198	56.6	63.7	80	#4-3
	7	380-3-50	342	418	35.3	250	70.8	79.6	100	#3-3
WH-800	4	460-3-60	414	506	45.5	310	91.2	102.6	150	#0-3
	5	575-3-60	518	632	36.5	239	73.2	82.3	125	#2-3
	7	380-3-50	342	418	45.5	310	91.2	102.6	150	#0-3

go to TABLE OF CONTENTS

W/WH-150 to 1000 High Voltage Schematic Diagram

Dual Circuit Scroll / Optional Domestic Hot Water



FUSE TABLE

Supply Voltage* (V-P-F**)	INPUT Value (VAC)	Fuse Value (mA)
208-3-60	208	-
460-3-60	460	330
575-3-60	575	250
380-3-50	380	500

* Refer to the unit nameplate or labels for the supply voltage value.

** Voltage - Phase - Frequency

REV	ECO #	IMPL BY	APVD BY	DATE
02	ISSUE 03	D. RHEAULT	D. RHEAULT	24-Jun-2022
02	ISSUE 02	D. RHEAULT	D. RHEAULT	15-Mar-2022
02	Reformatted	D. RHEAULT	D. RHEAULT	01-Nov-2017
01	Initial Release	C. GEDDES	C. GEDDES	18-Oct-2012

Drawn By Chris Geddes	Date 18-Oct-2012
Checked By Chris Geddes	Date 18-Oct-2012
Approved By (ENG) Chris Geddes	Date 18-Oct-2012
Approved By (MFG)	Date
Approved By	Date

MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4

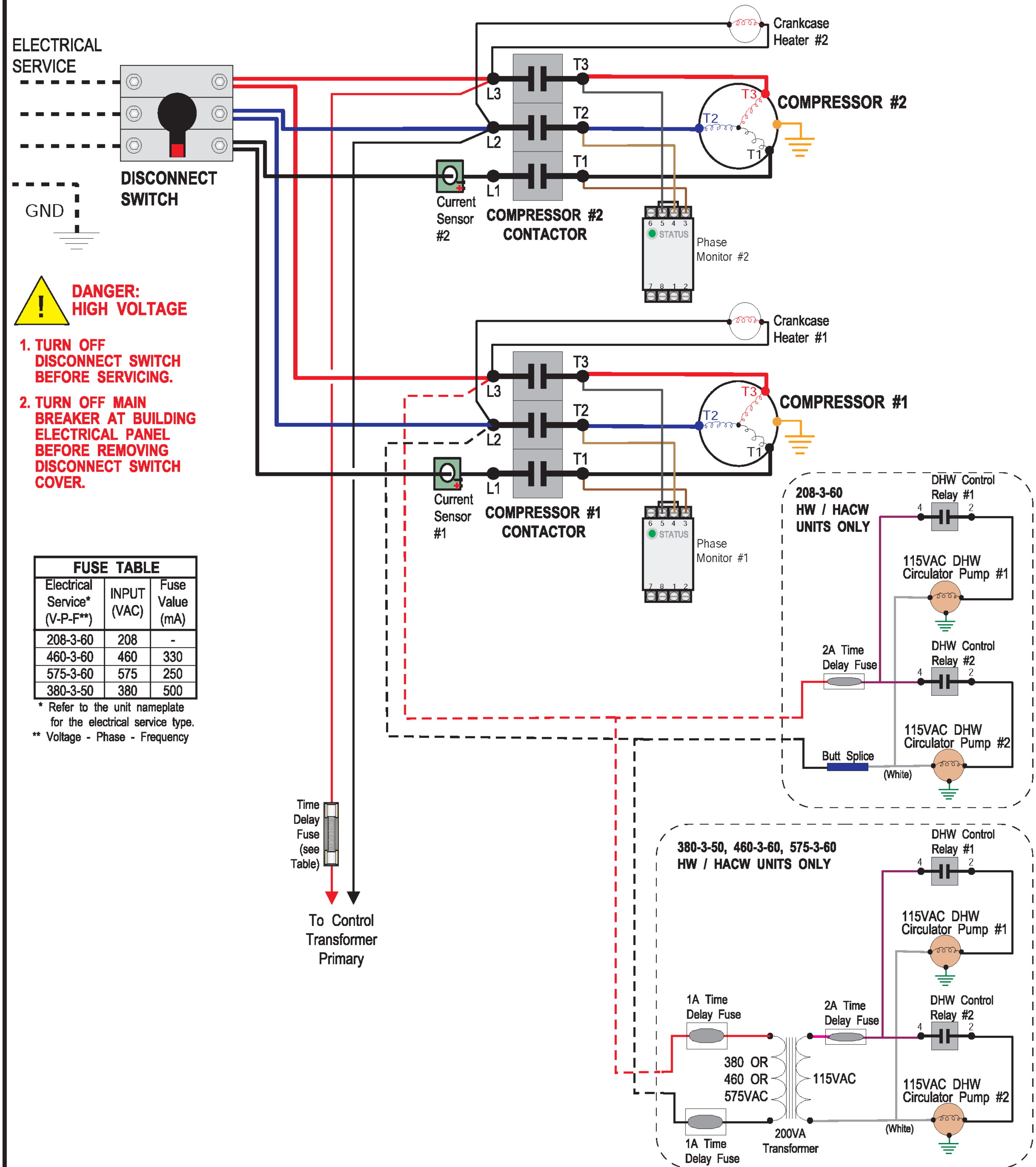
Drawing Name: W/WH-150 to W/WH-1000-H***-**-*D-PP High Voltage Schematic Diagram

Size	Drawing Number	Drawing Rev	SHEET
A	001717SCH	02(i3)	1 of 1

go to TABLE OF CONTENTS

W/WH-150 to 1000 High Voltage Schematic Diagram

Dual Circuit Scroll / Optional Domestic Hot Water / with Unit Mounted Disconnect



DANGER: HIGH VOLTAGE

1. **TURN OFF DISCONNECT SWITCH BEFORE SERVICING.**
2. **TURN OFF MAIN BREAKER AT BUILDING ELECTRICAL PANEL BEFORE REMOVING DISCONNECT SWITCH COVER.**

FUSE TABLE

Electrical Service* (V-P-F**)	INPUT (VAC)	Fuse Value (mA)
208-3-60	208	-
460-3-60	460	330
575-3-60	575	250
380-3-50	380	500

* Refer to the unit nameplate for the electrical service type.
** Voltage - Phase - Frequency

REV	ECO #	IMPL BY	APVD BY	DATE
01	ISSUE 03	D. RHEAULT	D. RHEAULT	24-Jun-2022
01	ISSUE 02	D. RHEAULT	D. RHEAULT	15-Mar-2022
01	Initial Release	D. RHEAULT	D. RHEAULT	4-Dec-2019

		Date
Drawn By	Dan Rheault	4-Dec-2019
Checked By	Dan Rheault	4-Dec-2019
Approved By (ENG)	Dan Rheault	4-Dec-2019
Approved By (MFG)		
Approved By		

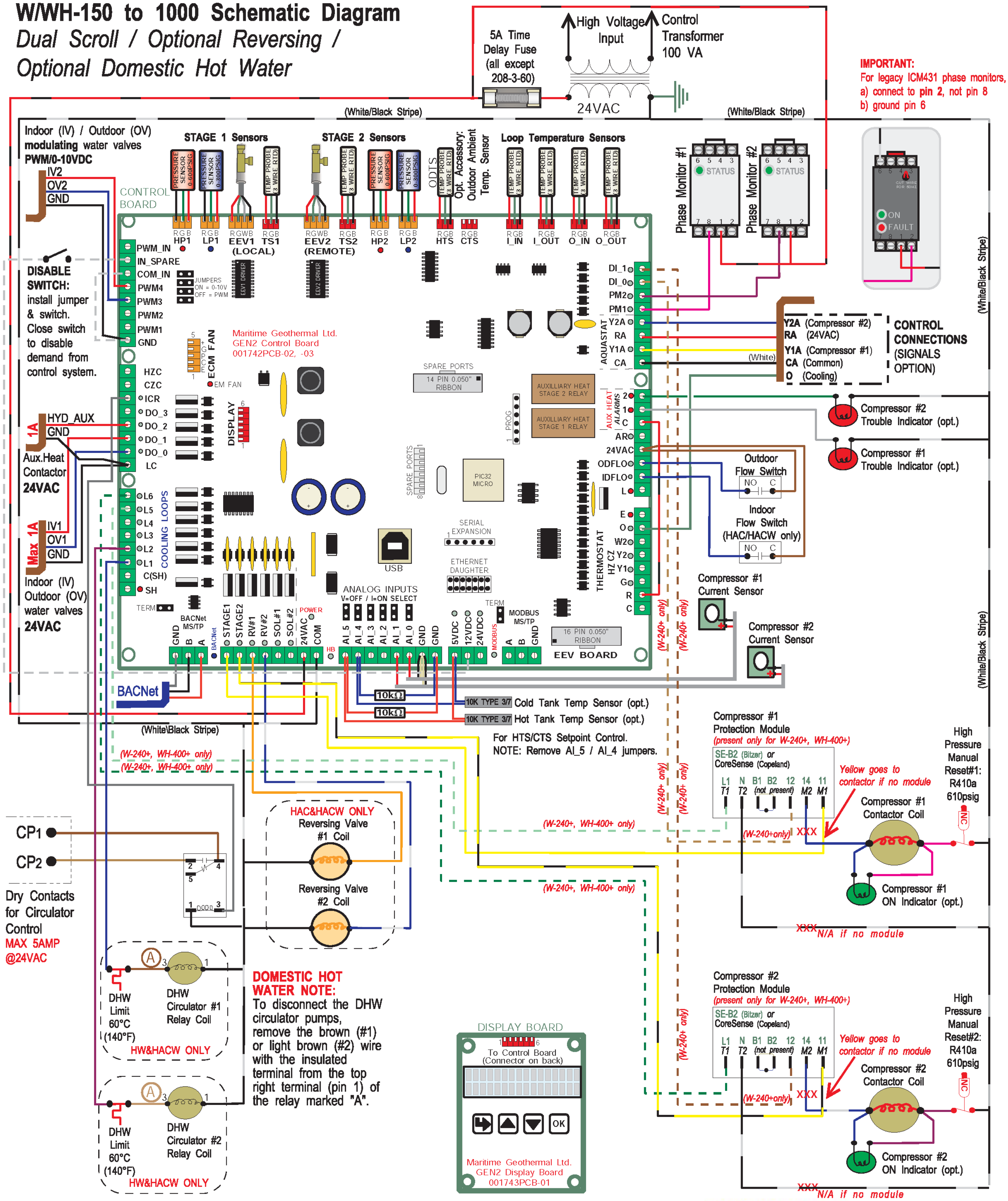
MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4

Drawing Name: W/WH-150 to W/WH-1000-H***-**-*D-PP w/Disconnect High Voltage Schematic Diagram

Size	Drawing Number	Drawing Rev	SHEET
A	002414SCH	01(i3)	1 of 1

go to TABLE OF CONTENTS

W/WH-150 to 1000 Schematic Diagram
Dual Scroll / Optional Reversing / Optional Domestic Hot Water



REV	ECO #	IMPL BY	APVD BY	DATE
04	ISSUE 03	D. RHEAULT	D. RHEAULT	24-Jun-2022
04	ISSUE 02	D. RHEAULT	D. RHEAULT	15-Mar-2022
04	000280	D. RHEAULT	D. RHEAULT	1-Dec-2020
03	Reformatted	D. RHEAULT	D. RHEAULT	12-Nov-2019
02	Reformatted	D. RHEAULT	D. RHEAULT	01-Nov-2017

Drawn By: Chris Geddes	Date: 18-Oct-2012
Checked By: Chris Geddes	Date: 18-Oct-2012
Approved By (ENG): Chris Geddes	Date: 18-Oct-2012
Approved By (MFG)	Date
Approved By	Date

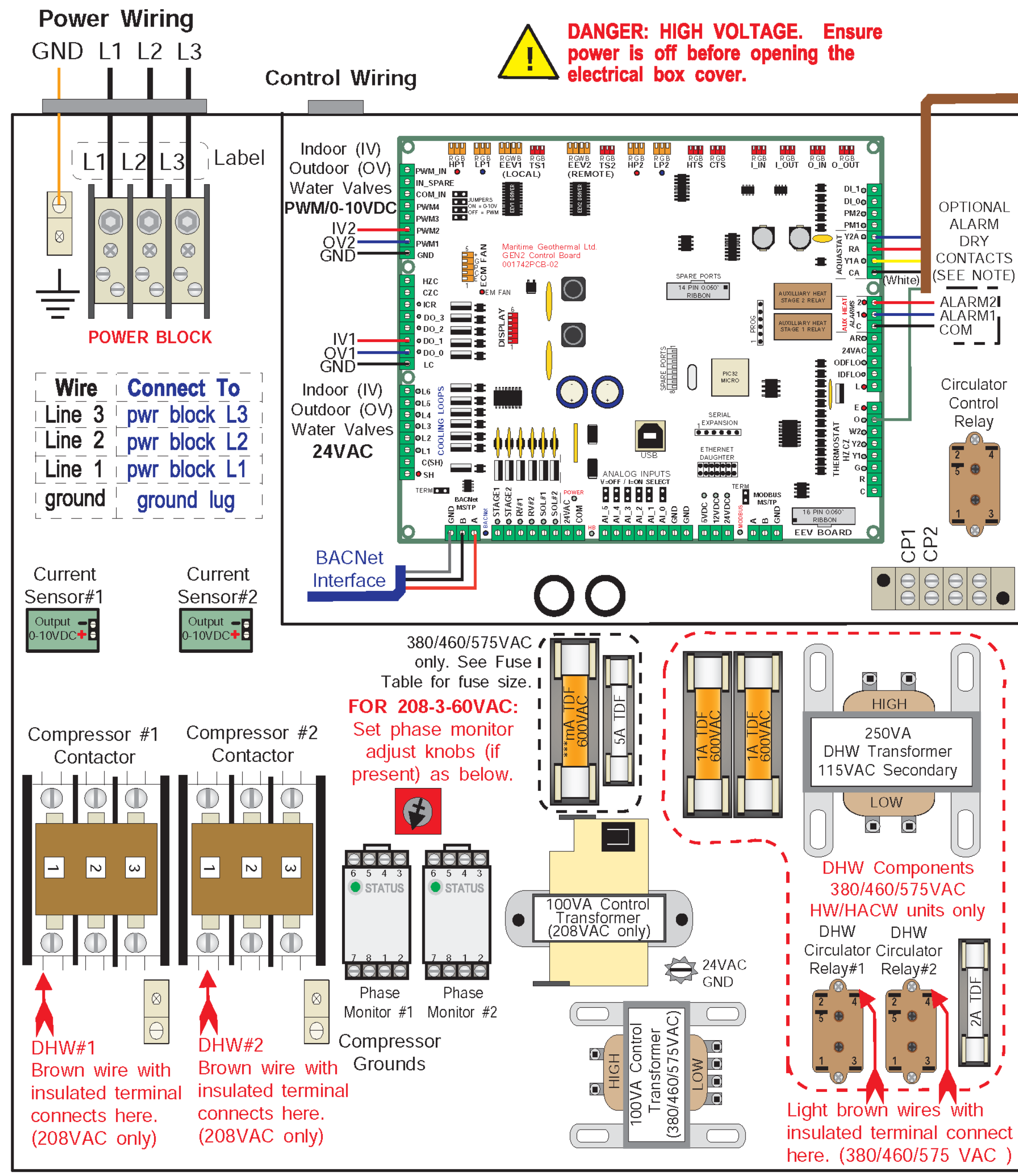
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: W/WH-150 to W/WH-1000-H***-**-*D-PP Schematic Diagram

Size	Drawing Number	Drawing Rev	SHEET
A	001718SCH	04(i3)	1 of 1

go to TABLE OF CONTENTS

W/WH-150 to 1000 Electrical Box Diagram



FUSE TABLE ***	
Supply Voltage	Fuse Value*
208-3-60	--------
460-3-60	330mA
575-3-60	250mA
380-3-50	500mA

*Value is marked in electrical box.

Use PC App or LCD menus to select 1 of 3 Control Methods:

1. **BACnet**
2. **Hardwired (24VAC signals)**
3. **Setpoint Control (internal)**

1. BACnet (MS/TP RS-485)

Use twisted pair shielded-conductor cable.

A - Communication
B - Communication
GND - Ground

SYSTEM_Y1A: Stage 1 (compr.1)
SYSTEM_Y2A: Stage 2 (compr.2)
SYSTEM_O: Htg/Cooling Mode (active in cooling)

2. Hardwired (24VAC)

Use an 18-4 or 18-5 cable.

C - 24VAC Common
R - 24VAC Hot
Y1A - Stage 1 (Compressor 1)
Y2A - Stage 2 (Compressor 2)
O - Heating/Cooling Mode (active for cooling mode)

A dry contact from "R" to "Y1A" will start compressor #1.

A dry contact from "R" to "Y2A" will start compressor #2.

A dry contact from "R" to "O" will activate cooling mode (for both compressors).

3. Setpoint Control

Unit will be controlled by internal water line temperature sensors. See manual for setup instructions.

DHW NOTE: If the heat pump is to be operated without the hot water circulators connected to the water tank and flooded with water, remove the brown (or light brown) wire with the insulated terminal from the location(s) shown in the diagram above. **The pumps are water lubricated and must not be run dry.**

IMPORTANT NOTES:

- **3 PHASE SCROLL COMPRESSORS** must rotate in the proper direction. After the initial connection, if the phase protection module(s) indicate a fault on power up, turn the power off and reverse the L1 and L2 supply leads. Turn the power on and clear the fault(s).

- **IMPORTANT:** Ensure sufficient antifreeze concentration is used and correctly set in control board via the PC App, so that the correct low pressure cutout value is implemented to prevent freezing conditions. Failure to do so could cause the heat exchanger to freeze and rupture, voiding the warranty.

- **Stages Y1A & Y2A** are completely independent (unlike with residential "Ultratech" compressors). Each may be used at any time.
- **Anti-short cycle timer** of 5 minutes exists for each compressor.
- **Alarm1 and Alarm2** signals are dry contacts (NO). Connect the signal source to COM. Alarm1 is for stage 1 (Y1A) and Alarm2 is for stage 2 (Y2A). MAX 1amp @ 24VAC
- **CP1 and CP2** are a dry contact that can be used to turn on circulator pumps when either compressor starts. In Setpoint Control mode, it is indoor circulators only (sampling). MAX 5amps @ 24VAC
- **Water Valve:** 24VAC is present across OV1/IV1 and GND to power an external ON/OFF water valve when either compressor starts. Modulating water valves can be connected between OV2/IV2 and GND. MAX 1amp @ 24VAC

REV	ECO #	IMPL BY	APVD BY	DATE
02	ISSUE 03	D. RHEAULT	D. RHEAULT	24-Jun-2022
02	ISSUE 02	D. RHEAULT	D. RHEAULT	15-Mar-2022
02	Reformatted	D. RHEAULT	D. RHEAULT	01-Nov-2017
01	Initial Release	C. GEDDES	C. GEDDES	18-Oct-2012

Drawn By: Chris Geddes	Date: 18-Oct-2012
Checked By: Chris Geddes	Date: 18-Oct-2012
Approved By (ENG): Chris Geddes	Date: 18-Oct-2012
Approved By (MFG)	Date
Approved By	Date

MARITIME GEOTHERMAL LTD. 170 Plantation Rd. Petitcodiac, NB E4Z 6H4

Drawing Name	W/WH-150 to W/WH-1000-H***-*-*D-PP Electrical Box Diagram

Size	Drawing Number	Drawing Rev	SHEET
A	001719ELB	02(i3)	1 of 1

go to TABLE OF CONTENTS

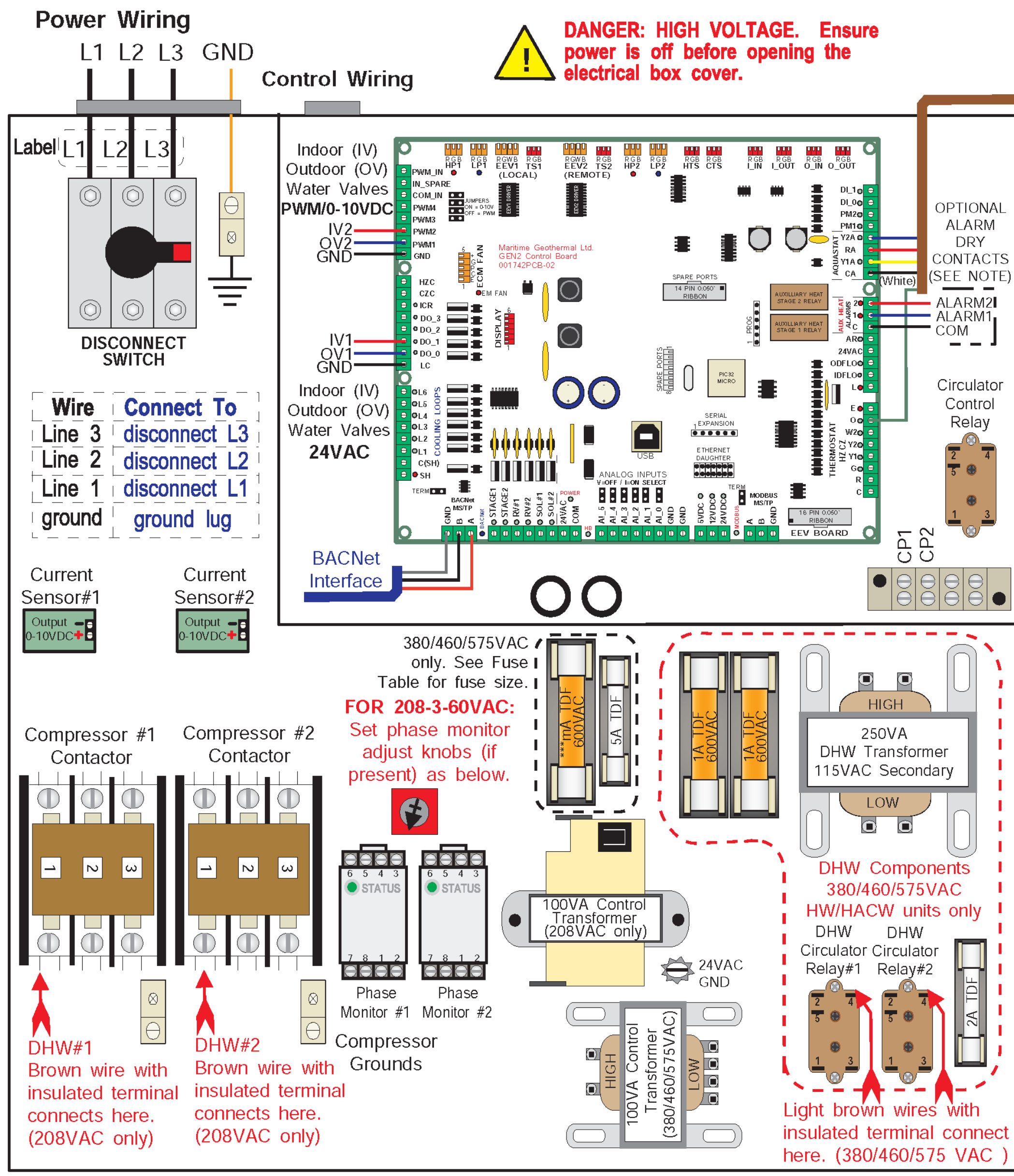
W/WH-150 to 1000 w/Disconnect Electrical Box Diagram

FUSE TABLE ***	
Supply Voltage	Fuse Value*
208-3-60	--------
460-3-60	330mA
575-3-60	250mA
380-3-50	500mA

*Value is marked in electrical box.

CONTROL CONNECTIONS (HARDWIRED OPTION)

Y2A(Compressor #2)
RA(24VAC)
Y1A(Compressor #1)
CA(Common)
O(Cooling)



DHW NOTE: If the heat pump is to be operated without the hot water circulators connected to the water tank and flooded with water, remove the brown (or light brown) wire with the insulated terminal from the location(s) shown in the diagram above. **The pumps are water lubricated and must not be run dry.**

Use PC App or LCD menus to select 1 of 3 Control Methods:

1. **BACnet**
2. **Hardwired (24VAC signals)**
3. **Setpoint Control (internal)**

1. BACnet (MS/TP RS-485)

Use twisted pair shielded-conductor cable.

A - Communication
B - Communication
GND - Ground

SYSTEM_Y1A: Stage 1 (compr.1)
SYSTEM_Y2A: Stage 2 (compr.2)
SYSTEM_O: Htg/Cooling Mode (active in cooling)

2. Hardwired/Signals (24VAC)

Use an 18-4 or 18-5 cable.

C - 24VAC Common
R - 24VAC Hot
Y1A - Stage 1 (Compressor 1)
Y2A - Stage 2 (Compressor 2)
O - Heating/Cooling Mode (active for cooling mode)

A dry contact from **R** to **Y1A** will start compressor #1.

A dry contact from **R** to **Y2A** will start compressor #2.

A dry contact from **R** to **O** will activate cooling mode (for both compressors).

3. Setpoint Control

Unit will be controlled by internal water line temperature sensors. See manual for setup instructions.

IMPORTANT NOTES:

- **3 PHASE SCROLL COMPRESSORS** must rotate in the proper direction. After the initial connection, if the phase protection module(s) indicate a fault on power up, turn the power off and swap the L1 and L2 supply leads. Turn the power on and clear the fault(s).

- **IMPORTANT:** Ensure sufficient antifreeze concentration is used and correctly set in control board via the PC App, so that the correct low pressure cutout value is implemented to prevent freezing conditions. Failure to do so could cause the heat exchanger to freeze and rupture, voiding the warranty.

- **Stages Y1A & Y2A** are completely independent (unlike with residential 2-stage compressors). Each may be used at any time.
- **Anti-short cycle timer** of 5 minutes exists for each compressor.
- **Alarm1 and Alarm2** signals are dry contacts (NO). Connect the signal source to COM. Alarm1 is for stage 1 (Y1A) and Alarm2 is for stage 2 (Y2A). MAX 1amp @ 24VAC
- **CP1 and CP2** are a dry contact that can be used to turn on circulator pumps when either compressor starts. In Setpoint Control mode, it is indoor circulators only (sampling). MAX 5amps @ 24VAC
- **Water Valve:** 24VAC is present across OV1/IV1 and GND to power an external ON/OFF water valve when either compressor starts. Modulating water valves can be connected between OV2/IV2 and GND. MAX 1amp @ 24VAC

REV	ECO #	IMPL BY	APVD BY	DATE
01	ISSUE 03	D. RHEAULT	D. RHEAULT	24-Jun-2022
01	ISSUE 02	D. RHEAULT	D. RHEAULT	15-Mar-2022
01	Initial Release	D. RHEAULT	D. RHEAULT	4-Dec-2019

Drawn By: Dan Rheault	Date: 4-Dec-2019
Checked By: Dan Rheault	Date: 4-Dec-2019
Approved By (ENG): Dan Rheault	Date: 4-Dec-2019
Approved By (MFG)	Date
Approved By	Date

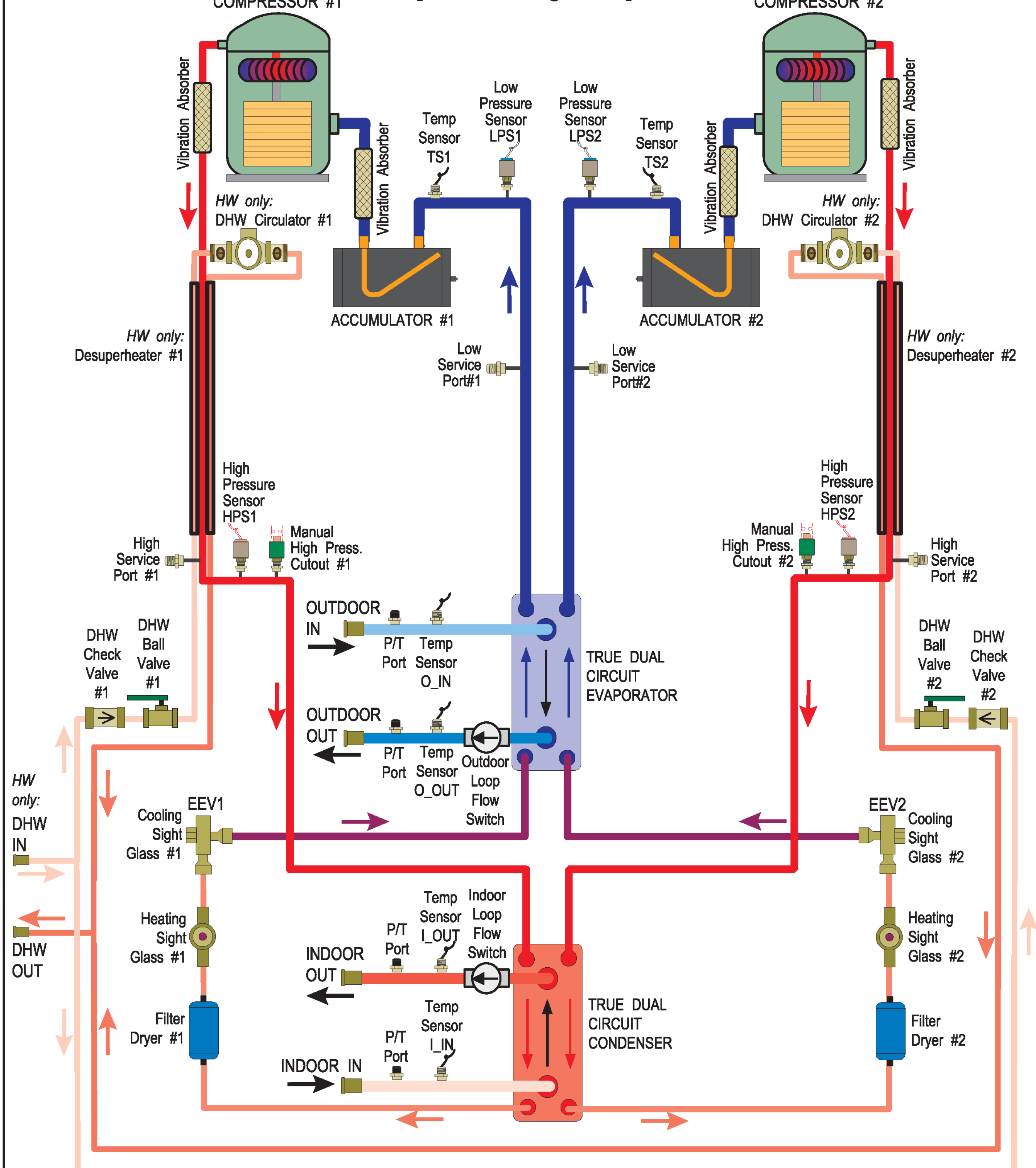
MARITIME GEOTHERMAL LTD.
170 Plantation Rd. Petitcodiac, NB E4Z 6H4

Drawing Name	W/WH-150 to W/WH-1000-H***-*-*D-PP w/Disconnect Electrical Box Diagram
Size	A
Drawing Number	002415ELB
Drawing Rev	01(i3)
SHEET	1 of 1

go to TABLE OF CONTENTS

W/WH-150 to 1000-H/HW Refrigeration Circuit

[No Reversing Valve]



REV	ECO #	IMPL BY	APVD BY	DATE
01(i2)	ISSUE 02	D. RHEAULT	D. RHEAULT	1-Jun-2022
01	Initial Release	C. GEDDES	C. GEDDES	23-Oct-2012

Drawn By: Chris Geddes	Date: 23-Oct-2012
Checked By: Chris Geddes	Date: 23-Oct-2012
Approved By (ENG): Chris Geddes	Date: 23-Oct-2012
Approved By (MFG)	Date
Approved By	Date

MARITIME GEOTHERMAL LTD.

170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

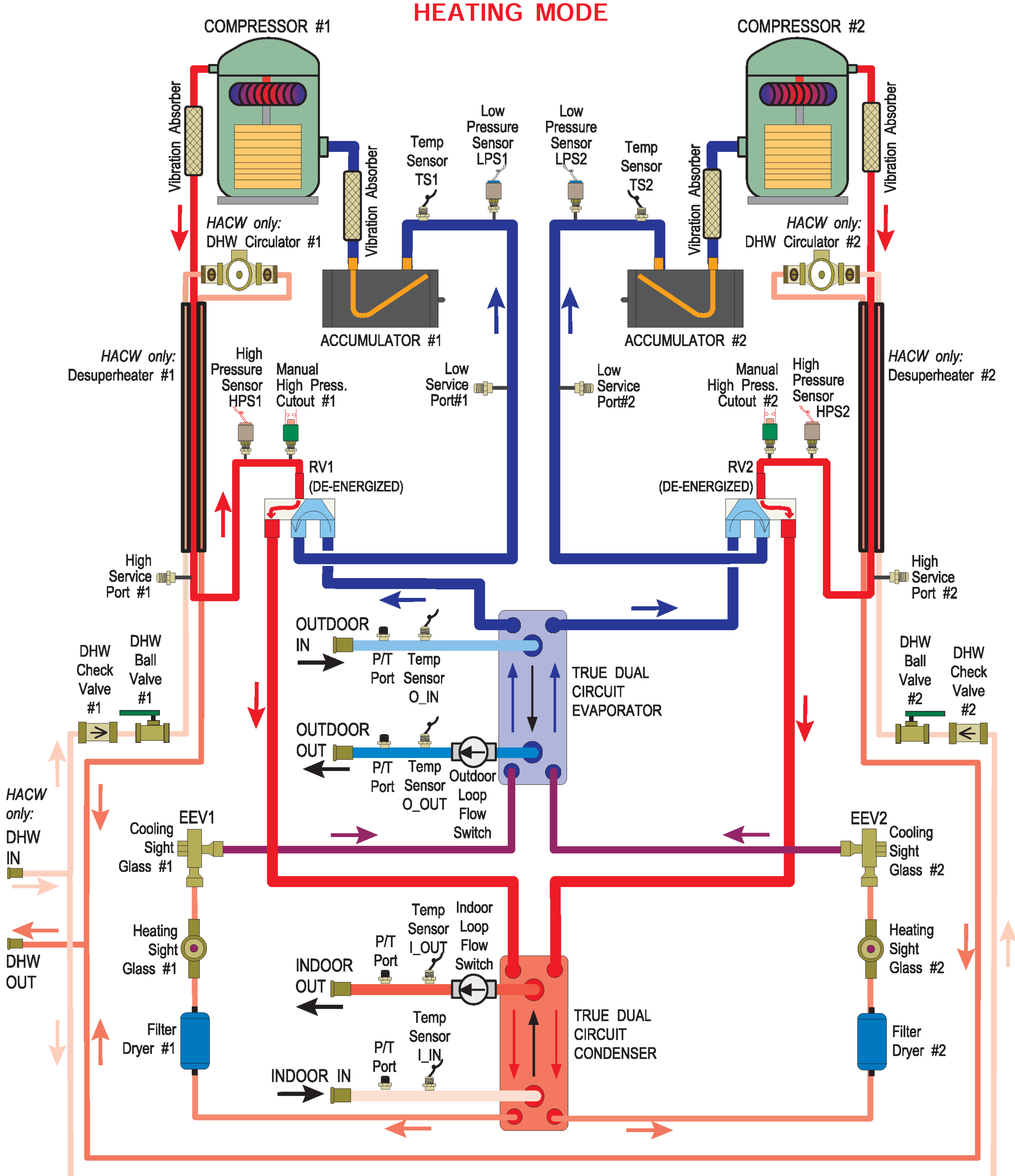
Drawing Name: W/WH-150 to 1000-H(W) Refrigeration Circuit Diagram

Size	Drawing Number	Drawing Rev	SHEET
A	001720RCD	01(i2)	1 of 1

go to TABLE OF CONTENTS

W/WH-150 to 1000-HAC/HACW Refrigeration Circuit

HEATING MODE



02	000303	D. RHEAULT	D. RHEAULT	1-Jun-2022
01	Initial Release	C. GEDDES	C. GEDDES	23-Oct-2012
REV	ECO #	IMPL BY	APVD BY	DATE

Drawn By Chris Geddes	Date 23-Oct-2012
Checked By Chris Geddes	Date 23-Oct-2012
Approved By (ENG) Chris Geddes	Date 23-Oct-2012
Approved By (MFG)	Date
Approved By	Date

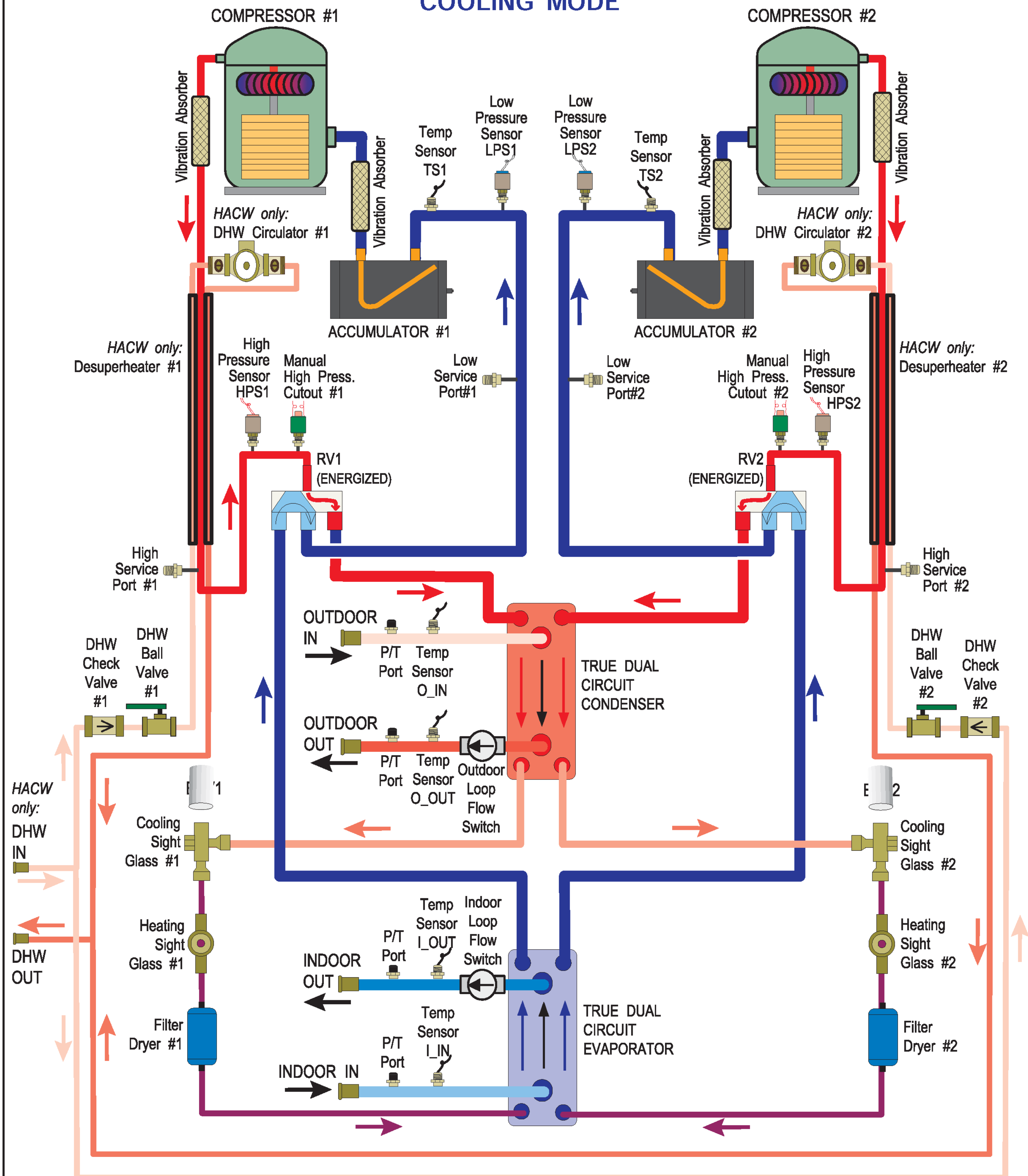
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name	W/WH-150 to 1000-HAC(W) Refrigeration Circuit Diagram - Heating Mode		
Size	Drawing Number	Drawing Rev	SHEET
A	001721RCD	02	1 of 1

go to TABLE OF CONTENTS

W/WH-150 to 1000-HAC/HACW Refrigeration Circuit

COOLING MODE



02	000303	D. RHEAULT	D. RHEAULT	1-Jun-2022
01	Initial Release	C. GEDDES	C. GEDDES	23-Oct-2012
REV	ECO #	IMPL BY	APVD BY	DATE

Drawn By: Chris Geddes	Date: 23-Oct-2012
Checked By: Chris Geddes	Date: 23-Oct-2012
Approved By (ENG): Chris Geddes	Date: 23-Oct-2012
Approved By (MFG)	Date
Approved By	Date

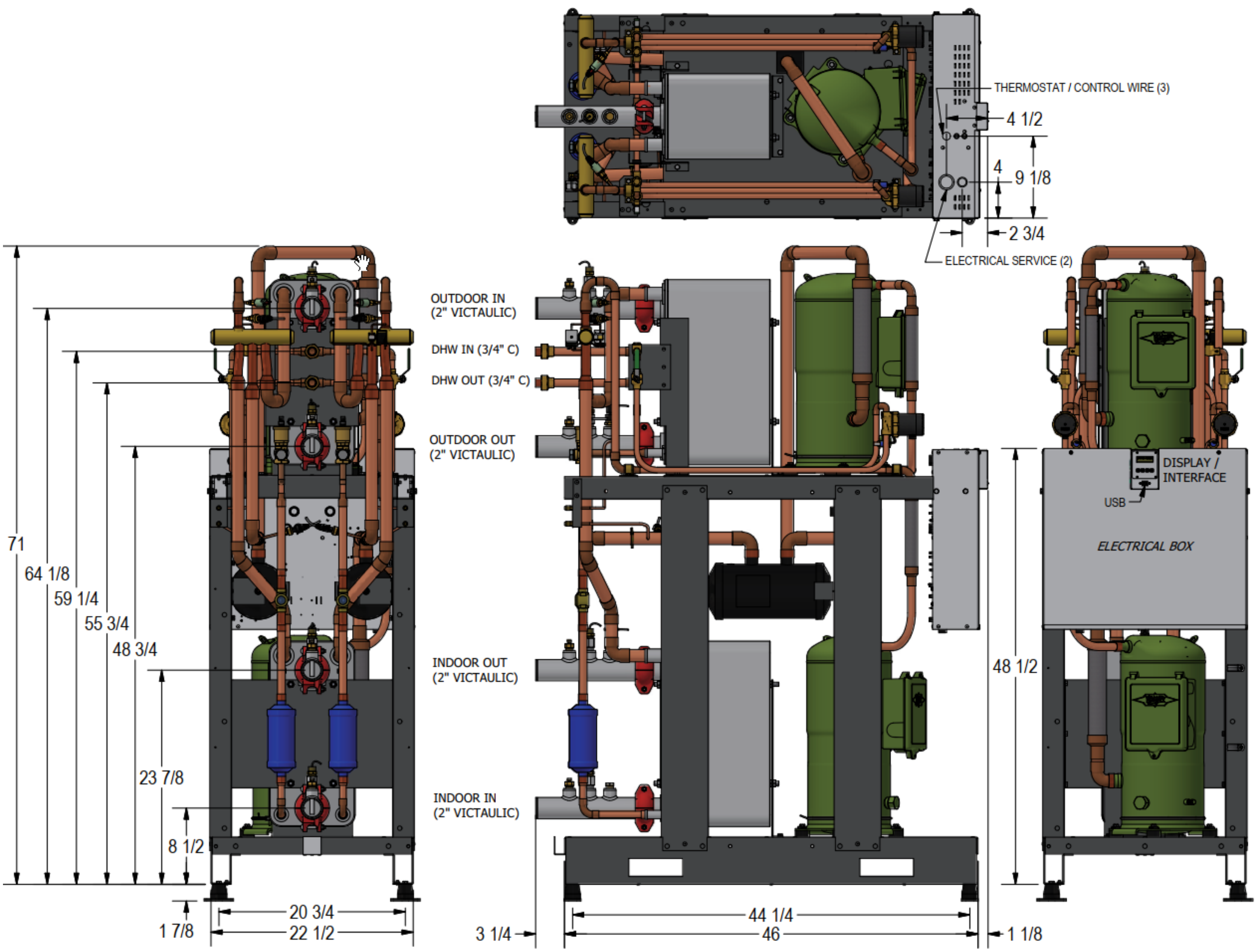
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: W/WH-150 to 1000-HAC(W) Refrigeration Circuit Diagram - Cooling Mode

Size	Drawing Number	Drawing Rev	SHEET
A	001722RCD	02	1 of 1

go to TABLE OF CONTENTS

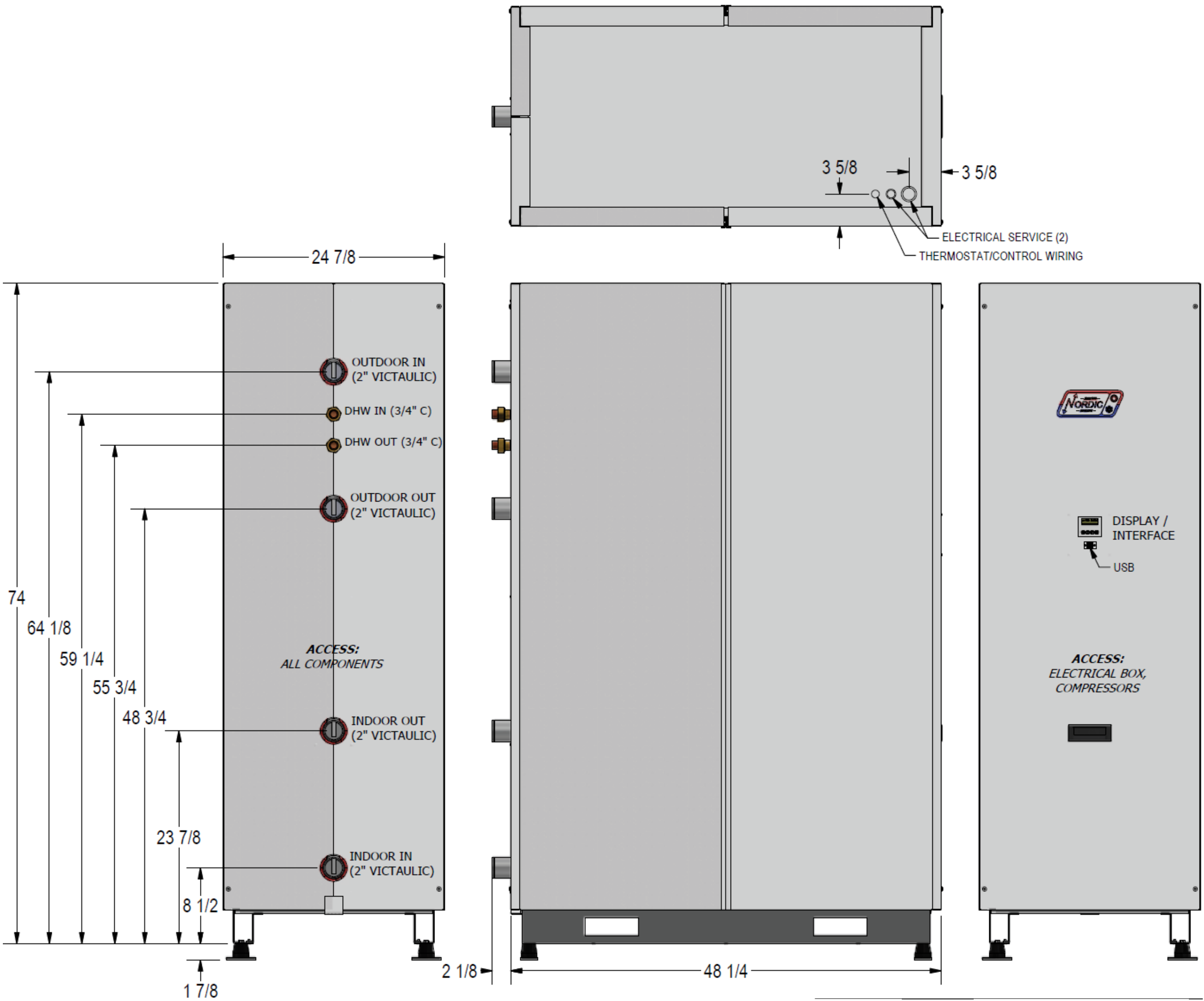
Dimensions: Without Enclosure (Sizes 150-400)



All dimensions in inches.

go to TABLE OF CONTENTS

Dimensions: With Enclosure (Sizes 150-400)



RECOMMENDED
BACK CLEARANCE:
3 FT + HEADERS

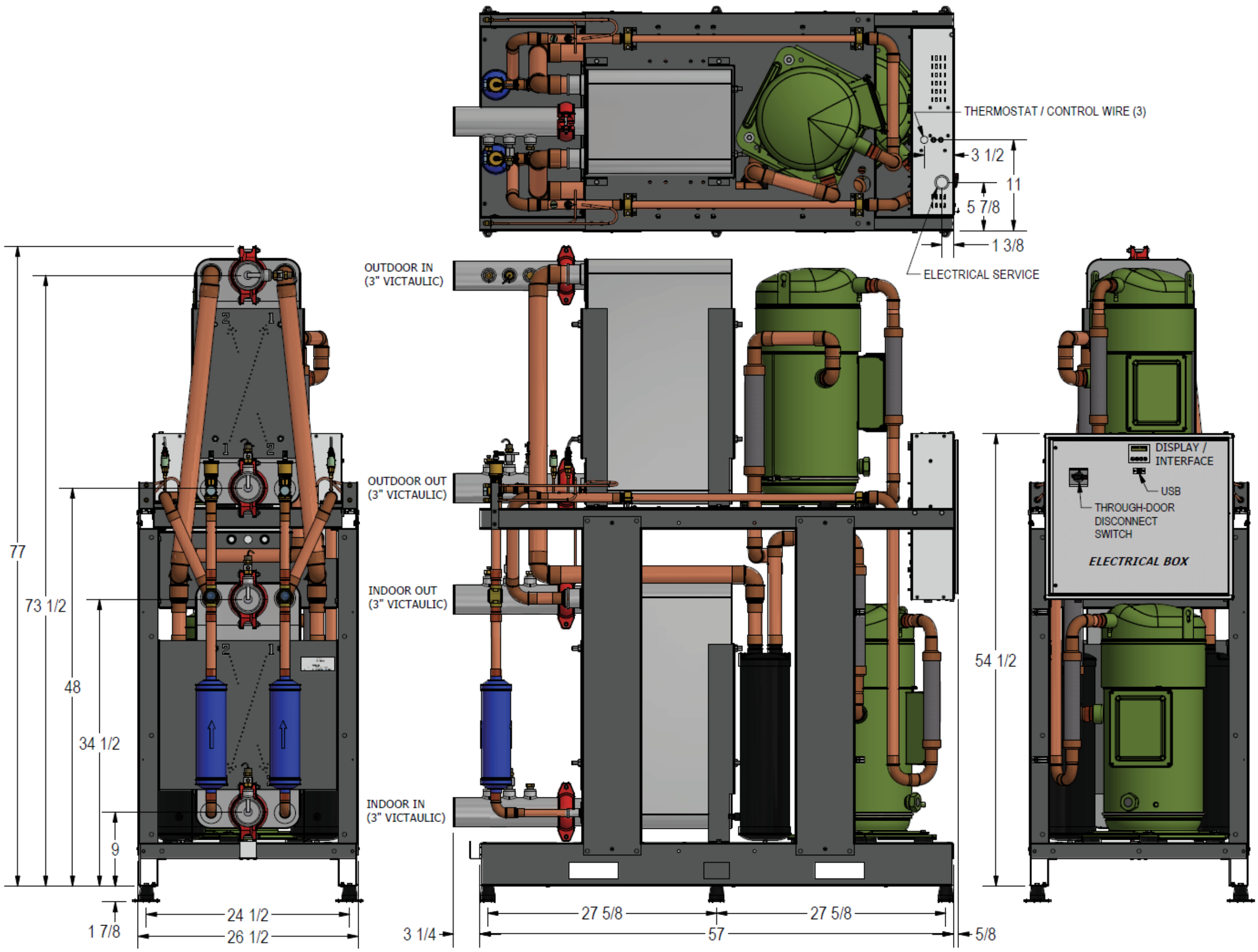
NO SIDE CLEARANCE REQUIRED

RECOMMENDED
FRONT CLEARANCE:
3 FT

All dimensions in inches.

go to TABLE OF CONTENTS

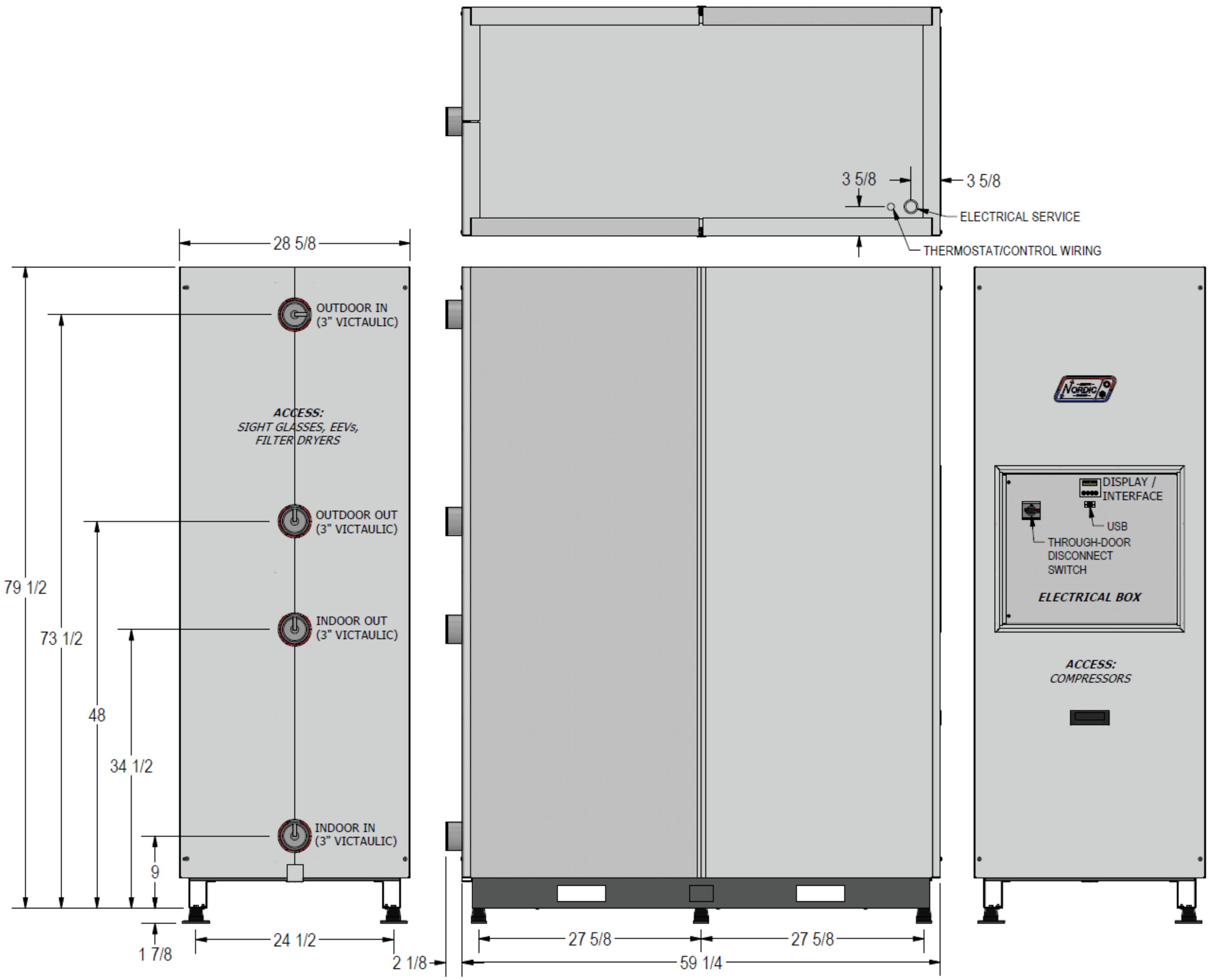
Dimensions: Without Enclosure (Sizes 500-1000)



All dimensions in inches.

go to TABLE OF CONTENTS

Dimensions: With Enclosure (Sizes 500-1000)



RECOMMENDED BACK CLEARANCE:
3 FT + HEADERS

NO SIDE CLEARANCE REQUIRED

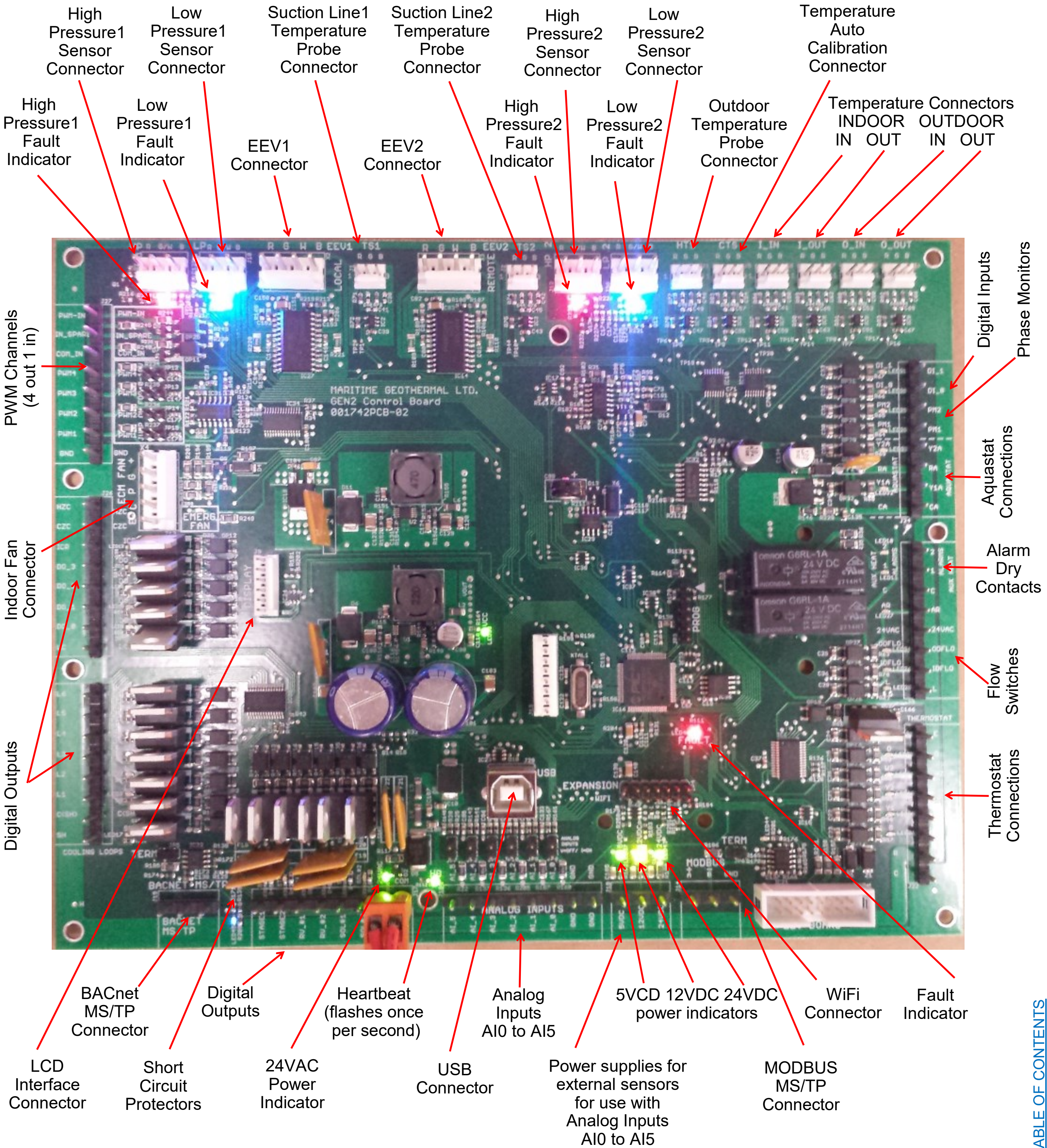
RECOMMENDED FRONT CLEARANCE:
3 FT

All dimensions in inches.

go to TABLE OF CONTENTS

Appendix A - GEN2 Control Board Description

The picture below shows the locations of the connectors and LED indicators of the control board. The control board offers many features such as short circuit protection on all digital outputs, Real Time Clock with super capacitor for backup power, WiFi capability, relay outputs for plenum heater control (if equipped), USB port, PIC32 microcontroller, etc.



go to TABLE OF CONTENTS

The tables describe the connections starting with the top of the board and working around the board counter clock-wise.

TABLE A1 - Control Board Connector Descriptions (Top)		
Name	**Description**	
HPS1/HI1	High Pressure Sensor 1	Measures stage 1 discharge pressure
LPS1/LO1	Low Pressure Sensor 1	Measures stage 1 suction pressure
EEV1	Local EEV	Control of stage 1 Electronic Expansion Valve
TS1	Suction Line Temperature 1	Mounted to stage 1 common suction line inside unit
EEV2	Remote EEV	Control of stage 2 Electronic Expansion Valve
TS2	Suction Line Temperature 2	Mounted to stage 2 common suction line inside unit
HPS2/HI2	High Pressure Sensor 2	Measures stage 2 discharge pressure
LPS2/LO2	Low Pressure Sensor 2	Measures stage 2 suction pressure
HTS/ODTS	Outdoor Temperature	Optional outdoor temperature sensor for outdoor reset feature
CTS	Auto Calibration	Resistor in connector for auto-calibration reference (32°F—0°C)
I_IN	Indoor Loop IN	Temperature sensor mounted to pipe inside unit
I_OUT	Indoor Loop OUT	Temperature sensor mounted to pipe inside unit
O_IN	Outdoor Loop IN	Temperature sensor mounted to pipe inside unit
O_OUT	Outdoor Loop OUT	Temperature sensor mounted to pipe inside unit

TABLE A2 - Control Board Connector Descriptions (Left Side)		
Name	**Description**	
PWM_IN	Signal for PWM IN	Unused
IN_SPARE	Spare digital input	Switch or dry contact from 12VDC to disable unit (also jumper COM_IN to GND)
COM_IN	Common for PWM IN	Jumper to GND for disable functionality
PWM4	PWM / 0-10VDC output	IV2 signal to control modulating water valve for indoor loop
PWM3	PWM / 0-10VDC output	OV2 signal to control modulating water valve for outdoor loop
PWM2	PWM / 0-10VDC output	Unused
PWM1	PWM / 0-10VDC output	Unused
GND	Ground	Jumper to COM_IN for disable functionality
HZC	Hot Zone Circulator	Unused
CZC	Cold Zone Circulator	Unused
ICR	Internal Circulator Relay	Signal for dry contact circulator control (CP1 And CP2)
DO_3	Digital output	Unused
DO_2	HYD_AUX	24VAC output to operate hydronic auxiliary heat (Setpoint Control only)
DO_1	IV1	IV1 signal for 24VAC water valve or circulator control for indoor loop
DO_0	OV1	OV1 signal for 24VAC water valve or circulator control for outdoor loop
LC	Loop common (ground)	Ground for 24VAC water valve / circulator controls
L6	Loop6	Compressor 2 protection module 24VAC power (sizes W-240 and up)
L5	Loop5	Compressor 1 protection module 24VAC power (sizes W-240 and up)
L4	Loop4	Unused
L3	TWO_TANK_3_WAY	Energizes 3-way valve to direct flow to cold tank when using HTS/CTS with 2 tanks
L2	Loop2	Desuperheater pump 2 enable (HACW/HW models only)
L1	Loop1	Desuperheater pump 1 enable (HACW/HW models only)
C(SH)	Soaker Hose common	Unused
SH	Soaker Hose	Unused

go to TABLE OF CONTENTS

TABLE A3 - Control Board Connector Descriptions (Bottom)		
Name	**Description**	
GND	BACnet MS/TP	Ground for shield if required (see BACnet Interface section)
B	BACnet MS/TP	RS-485
A	BACnet MS/TP	RS-485
STAGE1	Compressor Stage 1	Starts / stops compressor 1
STAGE2	Compressor Stage 2	Starts / stops compressor 2
RV#1	Reversing Valve#1	Off in heating mode, on in cooling mode (reversing HAC models only)
RV#2	Reversing Valve#2	Off in heating mode, on in cooling mode (reversing HAC models only)
SOL#1	Solenoid#1	Unused
SOL#2	Solenoid#2	Unused
24VAC	Power supply for board	24VAC power for control board
COM	Power supply for board	GND for control board
AI_5	Analog In Channel 5	Optional type 3/7 10k hot tank temperature sensor for HTS/CTS Setpoint Control
AI_4	Analog In Channel 4	Optional type 3/7 10k cold tank temperature sensor for HTS/CTS Setpoint Control
AI_3	Analog In Channel 3	0 to 5VDC or 4-20mA user settable with board jumper
AI_2	Analog In Channel 2	0 to 5VDC or 4-20mA user settable with board jumper
AI_1	Analog In Channel 1	Compressor 2 current sensor
AI_0	Analog In Channel 0	Compressor 1 current sensor
GND	Ground pin	Ground for analog sensors
GND	Ground pin	Ground for analog sensors
5VDC	Power for analog sensors	5VDC power supply for sensors
12VDC	Power for analog sensors	12VDC power supply for sensors
24VDC	Power for analog sensors	24VDC power supply for sensors
A	MODBUS	RS-485
B	MODBUS	RS-485
GND	MODBUS	Ground for shield if required

go to TABLE OF CONTENTS

TABLE A4 - Control Board Connector Descriptions (Right Side)		
Signal	**Description**	
DI_1	Digital Input 1	Compressor 2 protection module alarm input
DI_0	Digital Input 0	Compressor 1 protection module alarm input
PM2	Phase Monitor 2	Phase monitor 2 alarm input
PM1	Phase Monitor 1	Phase monitor 1 alarm input
Y2A*	Aquastat stage 2	Used only for external aquastat (Signals/Hardwired) control
RA*	Aquastat power (24VAC)	Used only for external aquastat (Signals/Hardwired) control
Y1A*	Aquastat stage1	Used only for external aquastat (Signals/Hardwired) control
CA*	Aquastat power (ground)	Used only for external aquastat (Signals/Hardwired) control
2	Stage 2 alarm	Dry contact to indicate stage 2 alarm, used with C
1	Stage 1 alarm	Dry contact to indicate stage 1 alarm, used with C
C	Alarm Common	Used with 2 and 1 above
AR	Airflow Reductions	Unused
24VAC	Power	24VAC to flow switch(es)
ODFLO	Outdoor Flow Switch	Return signal from outdoor loop flow switch
IDFLO	Indoor Flow Switch	Return signal from indoor loop flow switch (reversing HAC models only)
L	Thermostat Lockout Indicator	24VAC output for trouble LED
E	Thermostat Emergency Heat	Unused
O	Thermostat Heat/Cool	24VAC input from external dry contact to activate cooling mode
W2	Thermostat Auxiliary Heat	Unused
Y2	Thermostat Stage2	Unused
Y1	Thermostat Stage1	Unused
G	Thermostat Fan	Unused
R	Thermostat Power (24VAC)	Unused
C	Thermostat Power (Ground)	Unused
*NOTE: There is no need for an external aquastat for most systems, since BACnet or Setpoint Control are more commonly used.		

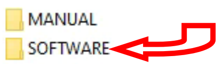
go to TABLE OF CONTENTS

Appendix B - USB Driver Installation (Windows 10 & earlier)

NOTE: This step is ***not necessary*** for **Windows 11**.

The first step in connecting a **Windows 10 or earlier** laptop computer to the control board is to install the USB driver.

The easiest way to install the USB driver is from the **USB drive included with the unit**. Insert the USB stick into a Windows computer, and open a File Explorer window to view its contents:

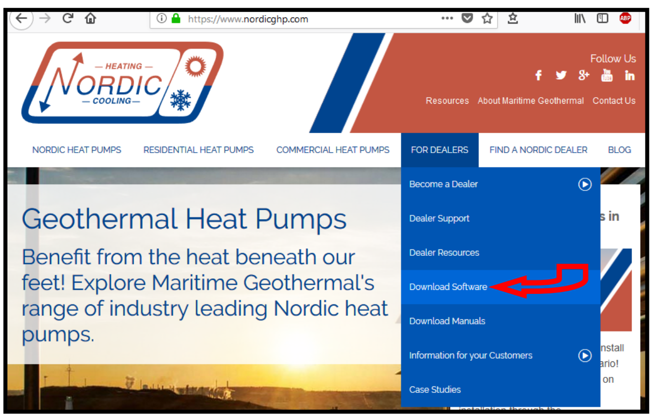


Double click on the SOFTWARE folder to show its contents:

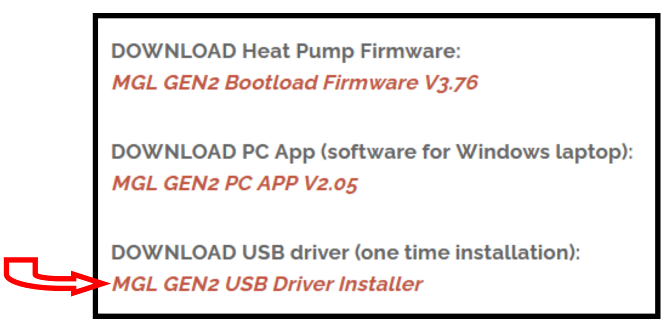
To install the USB driver, double click on **Step 1** and follow the prompts, clicking “allow” or “yes” as required.

If the USB drive is not available, the same files can be **down-loaded from the web page**.

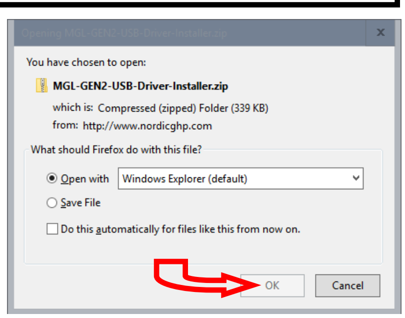
1. Go to www.nordicghp.com, Download Software page:



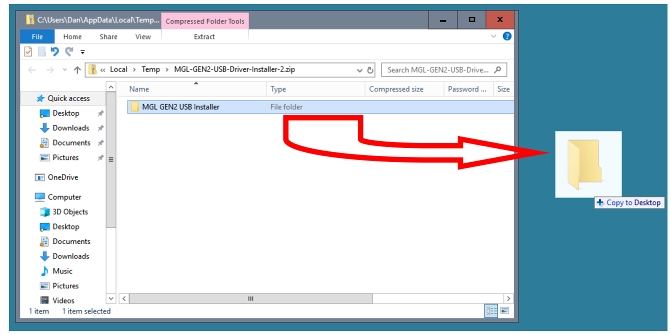
2. Click on **MGL GEN2 USB Driver Installer** to download it:



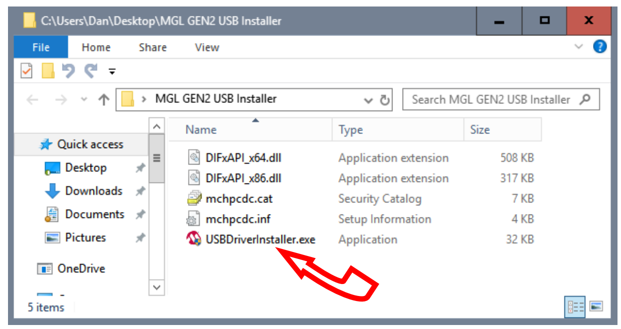
3. Choose “Open with Windows Explorer”, and hit “OK”. *(If the choice window doesn’t pop up, find the downloaded file in your browser downloads and double click on it.)*



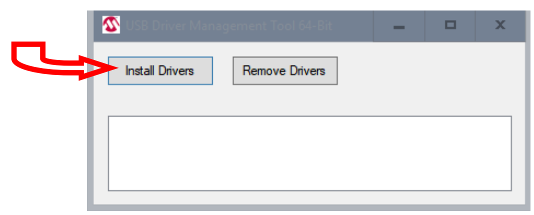
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



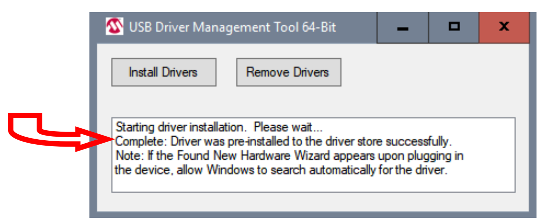
5. Double click on the folder you just dragged onto the desktop, then double click on the “USBDriverInstaller” file:



6. In the next window, click on “Install Drivers”:



7. You will see a message indicating the driver was installed successfully. You are now ready to install the PC App.

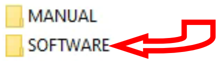


go to TABLE OF CONTENTS

Appendix C - PC App Installation (Windows 11)

The PC App allows detailed interfacing with the control board using a Windows laptop computer. These instructions are for ***Windows 11***.

The easiest way to install the PC App is from the **USB drive included with the unit**. Insert the USB stick into a Windows computer, and open a File Explorer window to view its contents:

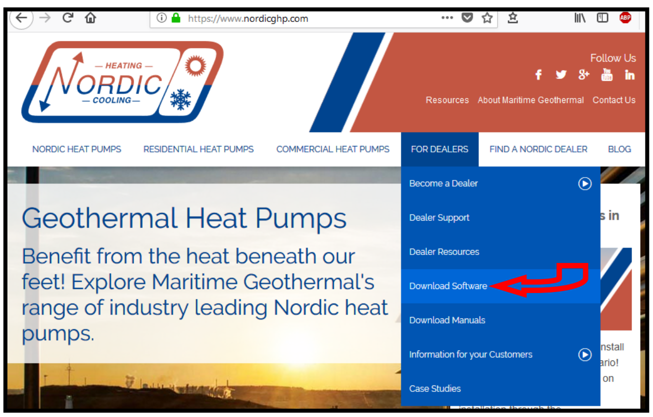


Double click on the SOFTWARE folder to show its contents:

Double click on **Step 2** and follow the prompts, clicking “More info”, “Run anyway”, “Install”, or similar on any warning windows which pop up, perhaps more than once. Pictures of warning windows you might encounter are shown below in step **8**.

If the USB stick drive is not available, the same file can be **downloaded from the web page**.

1. Go to www.nordicghp.com, Download Software page:



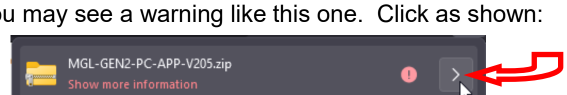
2. Click on **MGL GEN2 PC APP V2__** to download it:

DOWNLOAD Heat Pump Firmware:
MGL GEN2 Bootload Firmware V3.76

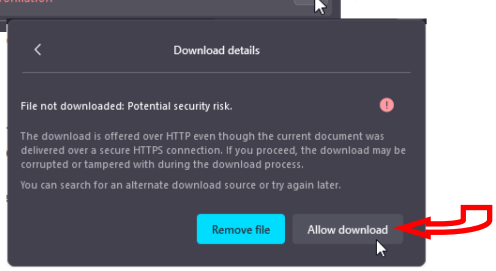
DOWNLOAD PC App (software for Windows laptop):
MGL GEN2 PC APP V2.05

DOWNLOAD USB driver (one time installation):
MGL GEN2 USB Driver Installer

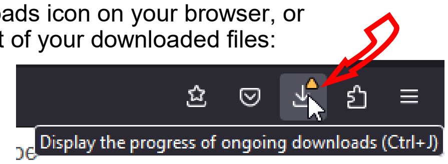
3. You may see a warning like this one. Click as shown:



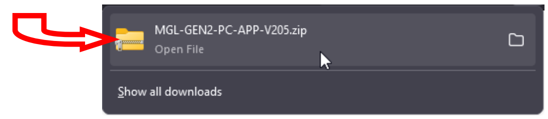
Then:



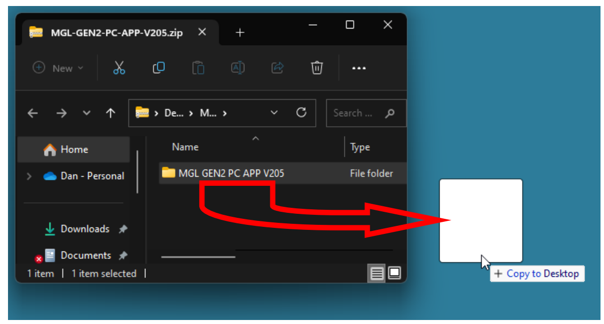
4. Click on the downloads icon on your browser, or otherwise view a list of your downloaded files:



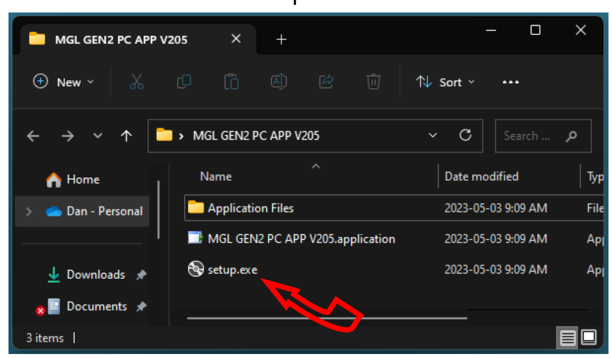
5. Then click on the .zip file to open it in a File Explorer window:



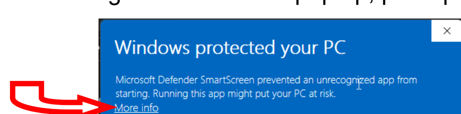
6. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



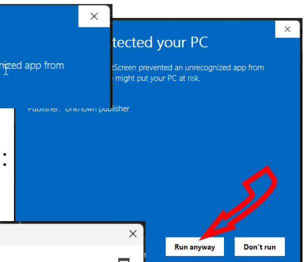
7. Double click on the folder you just dragged onto the desktop, then double click on the “setup” file:



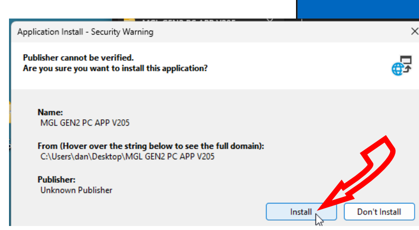
8. Click “More info”, “Run anyway”, “Install”, or similar on any warning windows which pop up, perhaps more than once.



Then:



And:



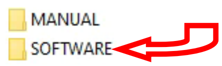
9. The PC App will open when it is finished installing. (In the future, it should be started from the start menu.) You are now ready to connect a USB cord between the laptop computer and GEN2 control board, and connect.

go to TABLE OF CONTENTS

Appendix D - PC App Installation (Windows 10 & earlier)

The PC App allows detailed interfacing with the control board using a Windows laptop computer. These instructions are for ***Windows 10 or earlier***. First, install the USB driver as per the previous appendix.

The easiest way to install the PC App is from the **USB drive included with the unit**. Insert the USB stick into a Windows computer, and open a File Explorer window to view its contents:

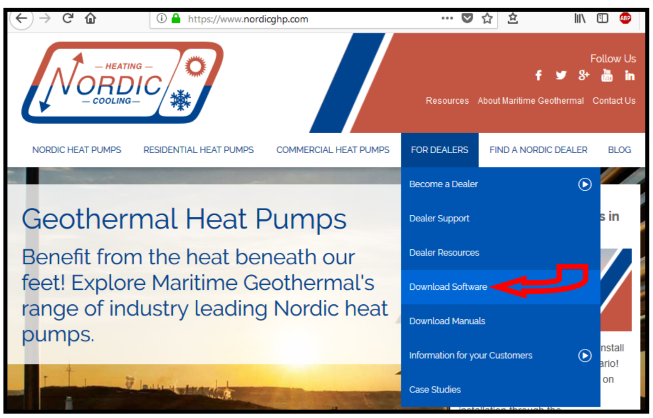


Double click on the SOFTWARE folder to show its contents:

Double click on **Step 2** and follow the prompts, clicking "allow" or "yes" as required. If you get a warning that .NET framework is required, go back and double click on step **z**, then try **Step 2** again.

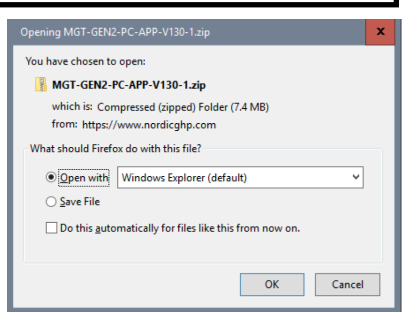
If the USB stick drive is not available, the same file can be **downloaded from the web page**.

1. Go to www.nordicghp.com, Download Software page:

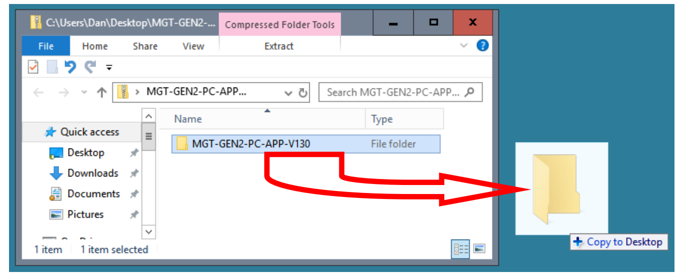


2. Click on **MGL GEN2 PC APP V2__** to download it:

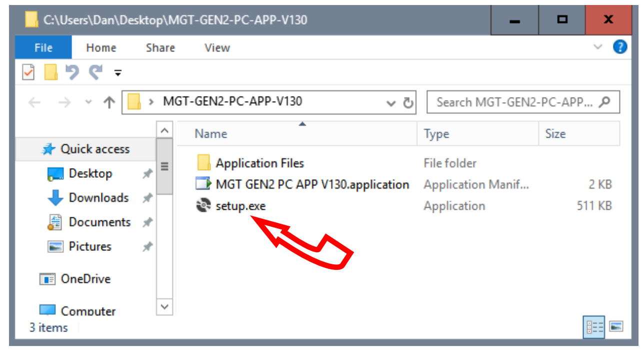
3. Choose "Open with Windows Explorer", and hit "OK":



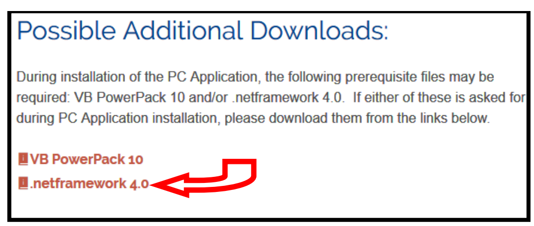
4. In the window that is displayed, click and hold down the mouse button on the folder name, and drag to your desktop:



5. Double click on the folder you just dragged onto the desktop, then double click on the "setup" file:



6. Click "Yes", "Run", "Install", or similar on any warning windows which pop up. If an error message is encountered regarding .NET framework, exit the installation and use the link on the Download Software page to install the missing item:



Then go back to step 5.

7. The PC App will open when it is finished installing. You are now ready to connect a USB cord between the laptop computer and GEN2 control board, and connect.

go to TABLE OF CONTENTS

Appendix E: Updating Firmware

METHOD 1: Updating Firmware Using PC App

This method can be used when updating newer control boards with bootloader version 2.0. This method will not work for older control boards with bootloader version 1.0 (approx. unit serial numbers -17 and lower); for those, see **METHOD 2**. Note that **METHOD 2** will work for all control boards.

The firmware comes as a .ZIP file named:
MGL GEN2 Bootload Firmware Vxxx.zip
where xxx is the version reference, e.g. 376 (version 3.76).
This file can be downloaded from **www.nordicghp.com**, menu *For Dealers --> Download Software*.

1. Download the file to your PC. When prompted, “Open” the zip file. If the zip file is *Saved* instead of *Opened*, find it in the web browser’s Downloads list or at the bottom of browser window and click on it to open. In the window that comes up, drag the folder containing the required files onto your desktop so that it can be found easily, e.g.:

   \Desktop\MGL GEN2 Bootload Firmware V376

   Also be sure the latest PC App version (e.g. v2.05) is installed, which is listed alongside the firmware on the web page. If needed, install a new version as per those instructions, and uninstall older PC App versions to avoid their accidental use (which can corrupt control board parameters).

2. In that folder on the Desktop, there will be three files:

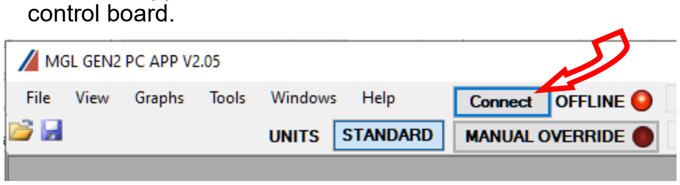
MGL_GEN2_V376.production.hex	(firmware file)
PIC32UBL.exe	(the programmer)
USB Bootloader Instructions.pdf	(these instructions)

   Note that on most computers, the file extensions (.exe, .pdf) will be hidden.

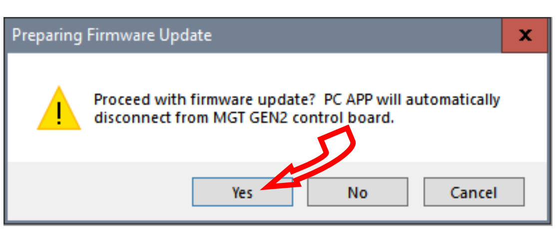
3. Connect a USB (printer) cable between computer and control board.

4. Launch the PC App version that matches the firmware (e.g. PC App 2.05 for firmware V3.76). After it is installed, the PC App can be started using the entry found under the “M” section in the Windows **START** menu, which is accessed using the 4-rectangles icon normally found at the bottom left corner of the computer screen.

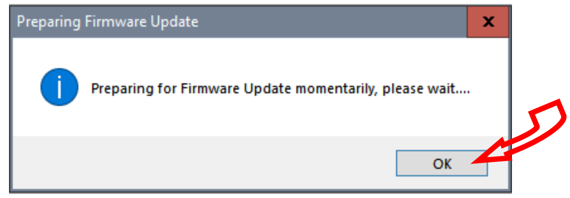
5. In the PC App, click on the **Connect** button to connect to the control board.



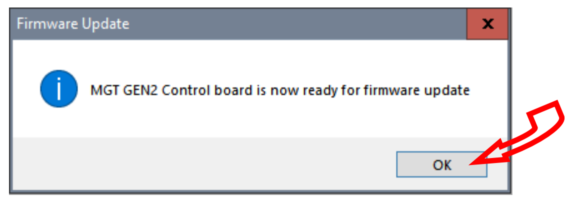
6. Go to menu **Tools --> Update Firmware**. The following message box will appear:



7. Click on **YES**. The following message box will appear:

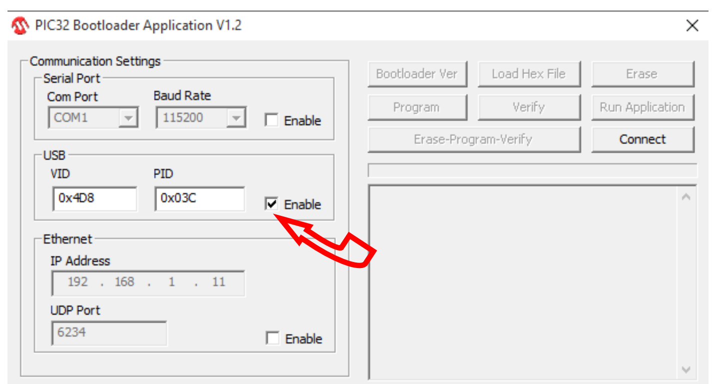


8. Click on **OK**. After a minute, the following message box will appear:

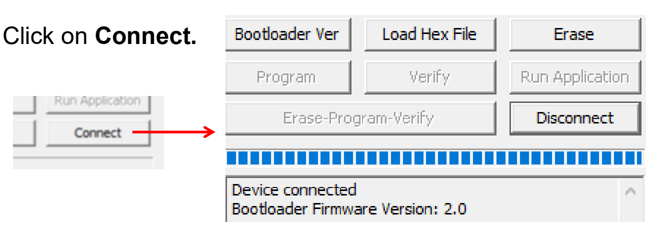


9. Click on **OK**. The control board is now in bootloader mode and is ready to be programmed.

10. Double click on the downloaded file PIC32UBL.exe to run it. In the window that opens, click on the USB **Enable** check box.



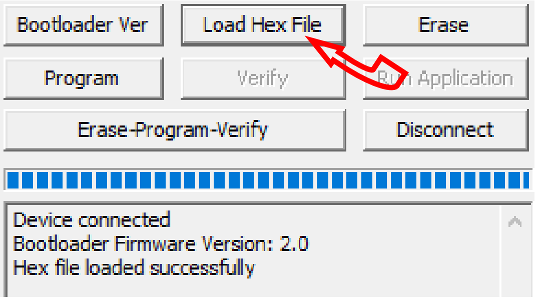
11. Click on **Connect.**



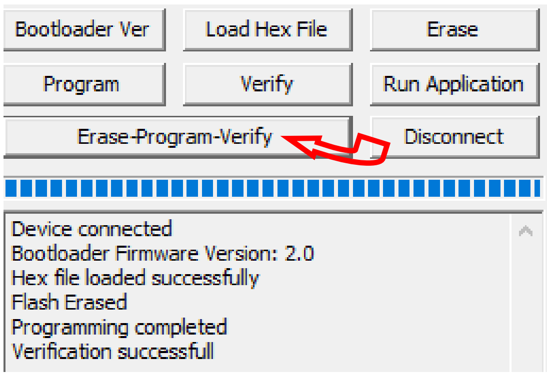
*If device fails to connect and an error message is displayed, the board’s bootloader may be older than v2.0. It will be necessary to instead update the firmware via jumper pins (**METHOD 2**), as per the next section.*

go to TABLE OF CONTENTS

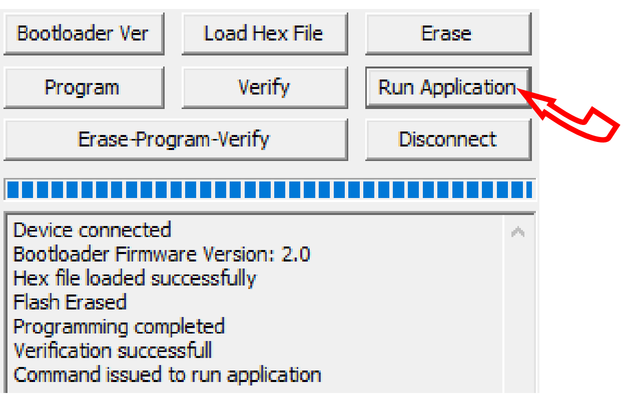
12. Click on **Load Hex File**. Select the *MGL_GEN2_V376.production.hex* (or higher version number) file, which is in the folder you created on the Desktop.



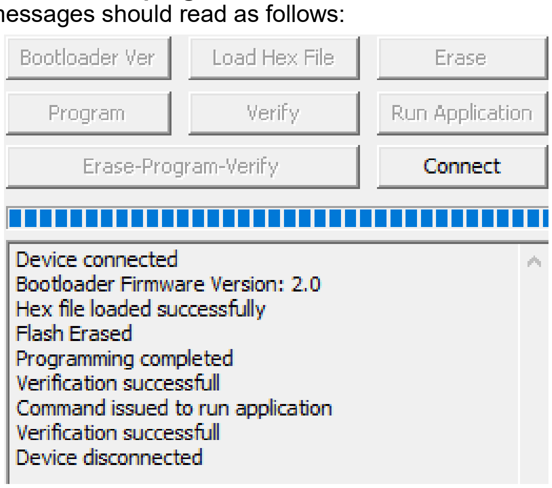
13. Click on **Erase—Program—Verify.** Programming…. Wait while status bar shows progress. The messages should read as below when finished:



11. "Programming completed. Verification successful." Click on **Run Application.** This will take the control board out of bootloader mode and back into normal operational mode, so that the PC App can connect again.



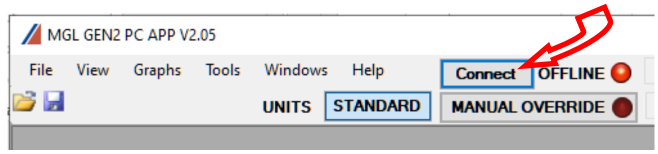
15. **Wait until the programmer disconnects itself.** The messages should read as follows:



16. Close the PIC32 program.

17. **WAIT APPROXIMATELY 10 SECONDS.** This gives the control board time to reset, initialize and re-connect to the PC USB port.

18. Go back to the PC APP and click on the **Connect** button. Verify that the firmware version, shown in the title bar after connection, has been updated. Perform any configuration needed.



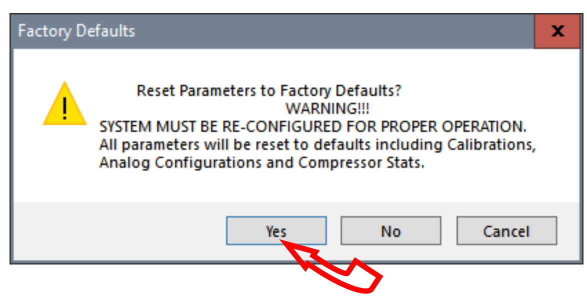
NOTE: Updating the firmware does not affect the configuration settings.

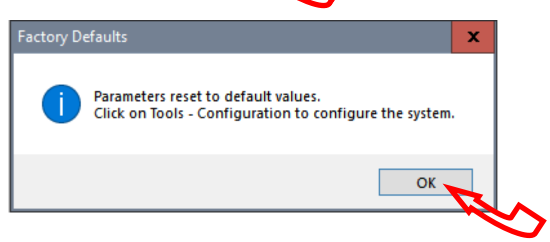
Reset to Defaults?

When updating from **firmware V3.75 or earlier**, the following steps must be taken after the update as there are significant differences in the internal parameters used to operate the system. These steps may also be performed for troubleshooting, when the control system is not acting as it should.

Note that if the firmware on a heat pumps is 2.45 or earlier, chances are that it will have an older bootloader version that requires the use of **METHOD 2** to update the firmware (see following page).

1. With PC App connected, go to menu **Tools --> Configuration** and note all settings. They will need to be re-set later.
2. Go to menu **Tools --> Reset To Factory Defaults.** Click **YES** in the pop up window, and OK in the next window.





3. Go back to menu **Tools --> Configuration**. Re-select the Model Series <u>even if it already indicates the proper series,</u> as clicking on it will load the parameters for that series.
4. Select the Model Size and make any other changes that apply to the particular system setup such as number of stages, control method, etc.

go to TABLE OF CONTENTS

METHOD 2: Updating Firmware Using Jumper Pins

This method should be used when updating older control boards that have bootloader version 1.0, or where the PC App has trouble connecting to older firmware. This method will work for all control boards and can be used on all units.

The firmware comes as a .ZIP file named:
MGL GEN2 Bootload Firmware Vxxx.zip
where xxx is the version reference, e.g. 376 (version 3.76). This file can be downloaded from **www.nordicghp.com**, menu *For Dealers --> Download Software.*

1. Download the file to your PC. When prompted, “Open” the zip file. If the zip file is *Saved* instead of *Opened*, find it in the web browser’s Downloads list or at the bottom of browser window and click on it to open. In the window that comes up, drag the folder containing the required files onto your desktop so that it can be found easily, e.g.:

   \Desktop\MGL GEN2 Bootload Firmware V376

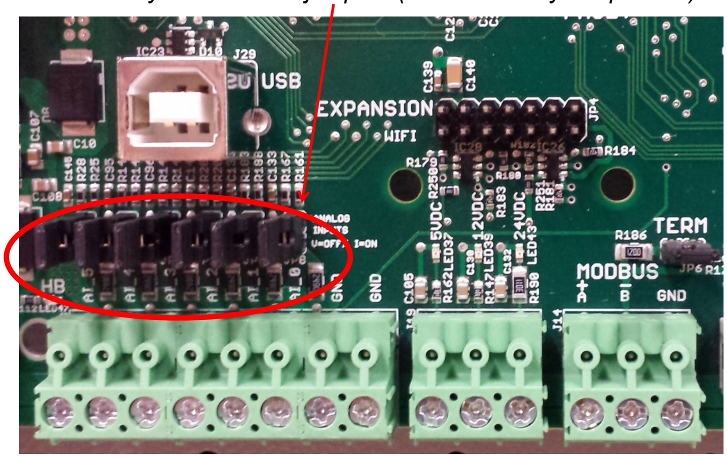
2. In that folder on the Desktop, there will be three files:

   MGL_GEN2_V376.production.hex (firmware file)
   PIC32UBL.exe (the programmer)
   USB Bootloader Instructions.pdf (these instructions)

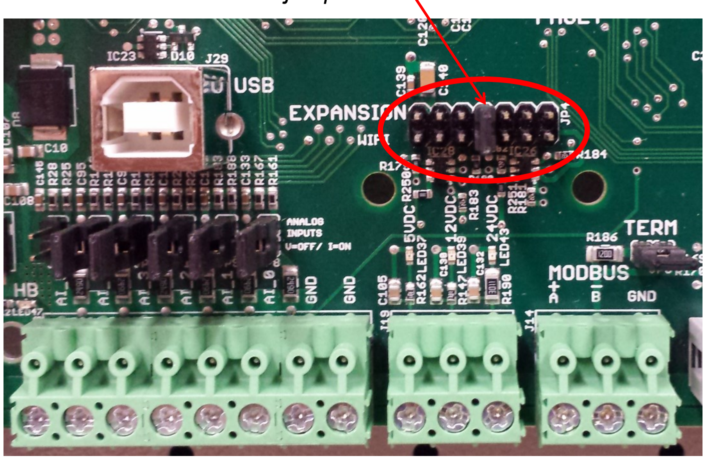
   Note that on most computers, the file extensions (.exe, .pdf) will be hidden.

3. Connect a USB (printer) cable between computer and control board.
4. Turn power off to the heat pump.
5. Remove one of the black pin jumpers from just below the USB connector on the board and place in on the center pin pair of the EXPANSION header as shown below.

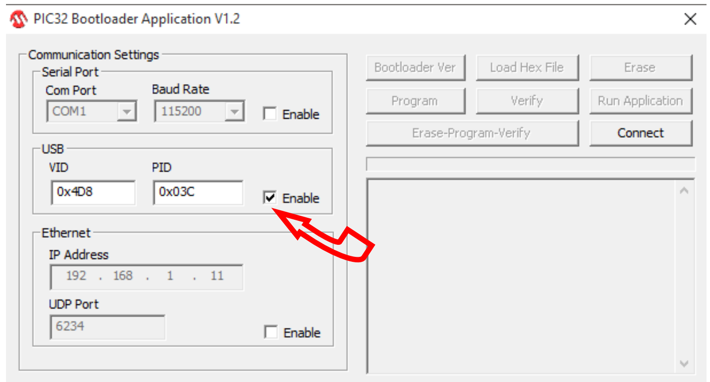
Borrow any one of these jumpers (however many are present)



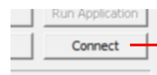
Place jumper here

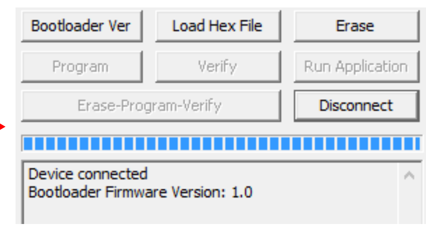


6. Turn the power back on. The control board is now in boot loader mode and is ready to be programmed.
7. Double click on the downloaded PIC32UBL.exe to run it. In the window that opens, click on the USB **Enable** check box.

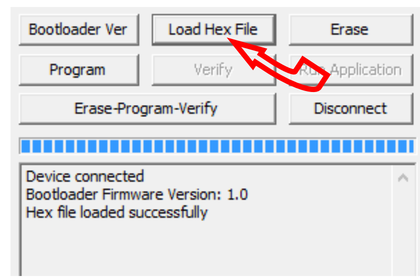


8. Click on **Connect.**



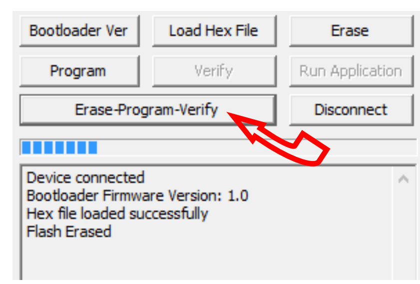


9. Click on **Load Hex File**. Select the *MGL_GEN2_V376. production.hex* (or higher version number) file, which is in the folder you created on the Desktop.

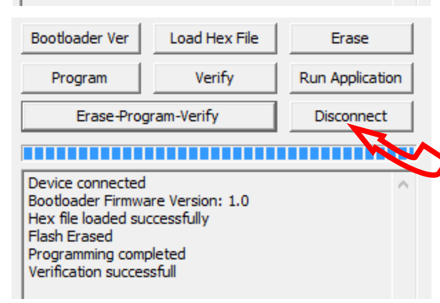


10. Click on **Erase—Program—Verify**

Programming…



11. “Programming completed. Verification successful.” Click on **Disconnect** and close the program.



12. Turn power off to the heat pump again.
13. Move the jumper back to where it was taken from.
14. Turn the power back on. Check that the LCD Display shows e.g. **MGL GEN2 V3.76** on the top line during power up.

go to TABLE OF CONTENTS

Warranty: W/WH-Commercial Series

COMMERCIAL LIMITED EXPRESS WARRANTY

Unless a statement is specifically identified as a warranty, statements made by Maritime Geothermal Ltd. (“MG”) or its representatives relating to MG’s products, whether oral, written or contained in any sales literature, catalogue or agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely MG’s opinion or commendation of MG’s products.
SET FORTH HERE IS THE ONLY EXPRESS WARRANTY THAT APPLIES TO MG'S PRODUCTS. MG MAKES NO WARRANTY AGAINST LATENT DEFECTS. MG MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.

LIMITED EXPRESS COMMERCIAL WARRANTY - PARTS
MG warrants its Commercial Class products, purchased and retained in the United States of America and Canada, to be free from defects in material and workmanship under normal use and maintenance as follows:
(1) Air conditioning, heating and/or heat pump units built or sold by MG (“MG Units”) for one (1) year from the Warranty Inception Date (as defined below).
(2) Thermostats, auxiliary electric heaters and geothermal pumping modules built or sold by MG, when installed with MG Units, for five (5) years from the Warranty Inception Date (as defined below).
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for one (1) year from the Warranty Inception Date (as defined below).
(4) Other accessories, when purchased separately, for (1) year from the date of shipment from MG.

The “Warranty Inception Date” shall be the date of original unit installation, as per the date on the installation Startup Record; or sixty (60) days from date of unit shipment from MG, whichever comes first.

To make a claim under this warranty, parts must be returned to MG in Petitcodiac, New Brunswick, freight prepaid, no later than ninety (90) days after the date of the failure of the part. If MG determines the part to be defective and within MG's Limited Express Commercial Warranty, MG shall, when such part has been either replaced or repaired, return such to a factory recognized distributor, dealer or service organization, freight prepaid. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

LIMITED EXPRESS COMMERCIAL WARRANTY - LABOUR
MARITIME GEOTHERMAL LTD. will not be responsible for any consequential damages or labour costs incurred.

This warranty does not cover and does not apply to:
(1) Air filters, fuses, refrigerant, fluids, oil.
(2) Products relocated after initial installation.
(3) Any portion or component of any system that is not supplied by MG, regardless of the cause of the failure of such portion or component.
(4) Products on which the unit identification tags or labels have been removed or defaced.
(5) Products on which payment to MG, or to the owner’s seller or installing contractor, is in default.
(6) Products subjected to improper or inadequate installation, including but not limited to:
- Indoor or outdoor loop flow lower than listed in engineering specification or as expressly approved by MARITIME GEOTHERMAL LTD.
- Operating the heat pump either manually or with automated controls so that the unit is forced to function outside its normal operating range
- Disabling of safety controls
- Insufficient loop antifreeze concentration for loop temperature, or antifreeze concentration incorrectly set in control board
- Fouled heat exchangers due to poor water quality
- Failure to use strainers or clean them regularly
- Impact or physical damage sustained by the heat pump
- Poor refrigeration maintenance practices, including brazing without nitrogen flow, or using wrong braze/flux
- Incorrect voltage or missing phase supplied to unit
- Unit modified electrically or mechanically from factory supplied condition
- Water quality outside of recommended limits (e.g. salinity or pH)
- Unit not mounted with supplied anti-vibration grommets when specified for use
- Corrosion damage due to corrosive ambient environment
- Failure due to excessive cycling caused by improper mechanical setup or improperly programmed external controller
- Physical loads or pressures placed on unit from external equipment

(7) Mold, fungus or bacteria damage
(8) Corrosion or abrasion of the product.
(9) Products supplied by others.
(10) Electricity or fuel, or any increases or unrealized savings in same, for any reason whatsoever.

MG is not responsible for:
(1) The costs of fluids, refrigerant or system components **supplied by others**, or associated **labour** to repair or replace the same, which is incurred as a result of a defective part covered by MG’s Limited Commercial Warranty.
(2) The costs of **labour**, refrigerant, materials, or service incurred in diagnosis and removal of defective part, or in obtaining and replacing the new or repaired part.
(3) Transportation costs of the defective part from the installation site to MG, or of the return of that part if warranty coverage declined.
(4) The costs of normal maintenance.

MG’S LIABILITY UNDER THE TERMS OF THIS LIMITED WARRANTY SHALL APPLY ONLY TO THE MG UNITS REGISTERED WITH MG THAT BEAR THE MODEL AND SERIAL NUMBERS STATED ON THE INSTALLATION START UP RECORD, AND MG SHALL NOT, IN ANY EVENT, BE LIABLE UNDER THE TERMS OF THIS LIMITED WARRANTY UNLESS THIS INSTALLATION START UP RECORD HAS BEEN ENDORSED BY OWNER & DEALER/INSTALLER AND RECIEVED BY MG LIMITED WITHIN 90 DAYS OF START UP.

Limitation: This Limited Express Commercial Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined that other warranties exist, any such express warranty, including without imitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Commercial Warranty.

LIMITATION OF REMEDIES
In the event of a breach of the Limited Express Commercial Warranty, MG will only be obligated at MG's option to repair the failed part or unit, or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to MG's factory in Petitcodiac, New Brunswick of each defect, malfunction or other failure, and a reasonable number of attempts by MG to correct the defect, malfunction or other failure, and the remedy fails of its essential purpose, MG shall refund the purchase price paid to MG in exchange for the return of the sold good(s). Said refund shall be the maximum liability of MG. **THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER OR PURCHASER AGAINST MG FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR MG’S NEGLIGENCE OR IN STRICT LIABILITY.**

LIMITATION OF LIABILITY
MG shall have no liability for any damages if MG’s performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to: any war, civil unrest, government restrictions or restraints, strikes, or work stoppages, fire, flood, accident, shortages of transportation, fuel, material, or labour, acts of God or any other reason beyond the sole control of MG. **MG EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR MG's NEGLIGENCE OR AS STRICT LIABILITY.**

OBTAINING WARRANTY PERFORMANCE
Normally, the dealer or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any MG recognized distributor, dealer or service organization. If assistance is required in obtaining warranty performance, write or call Maritime Geothermal Ltd.

NOTE: Some states or Canadian provinces do not allow limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and from Canadian province to Canadian province.

go to TABLE OF CONTENTS